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ELECTRICAL WORLD AND ENGINEER.

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OHIO ELECTRIC LIGHT ASSOCIATION.

Elsewhere we print a report of the meeting at Columbus, of the Ohio Electric Light Association, with brief abstracts of such papers as were available for that purpose. One of the papers, treating in a practical manner with heating from central stations, is reserved for printing in full in a following issue. This is by far the best of the local electric light associations, and many similar organizations would be greatly benefitted by taking it as a model. The list of papers read annually is always extensive, the topics are almost invariably of live interest, and as a rule are treated by engineers and central station managers qualified for the task. The contributions from manufacturing companies are intelligently worked into the programme, the topics to be treated apparently being fixed by the Association. At Columbus, for example, one entire session was devoted to meters and another to alternating series arc lighting, at which sessions technical representatives of companies exploiting these classes of apparatus in turn read papers relating thereto, some of which went beyond making a mere commercial presentation of the subject. The growing custom of manufacturing companies to detail members of their technical staff to prepare papers for presentation at the meetings of electrical associations is fraught with much benefit for the members of such bodies if intelligently availed of, and the Ohio Association has been able to profit largely from this source by giving to the matter the necessary thought in constituting its programmes.

Two of the sessions of the meeting were assigned to the important managerial question—how to increase the revenue from a central station plant. Perhaps because in the past the subject has been so thoroughly threshed over, no particularly novel views were presented in its discussion. Stress was laid on the value of intelligent and unflagging solicitation for new business; intelligent in that the solicitor should make a study of existing conditions, and thereby be in a position to advise a prospective customer as to the most economical disposition for his case. The matter of rates cropped up, and though the equity, both to seller and consumer, was acknowledged of the modern systems which base charges partly on current used and partly on other considerations, yet sight was not lost of the difficulty in their introduction, due to obtuseness of consumers to such other considerations, and to the fact that gas companies—the doughty competitors of electricity—do not make any discrimination between clas of customers.

By long odds the most promising means advocated for increasing the incomes of central stations, and more particularly the smaller ones, is the addition of steam heat to the station output. One of the contributors of papers gave figures showing that the smaller central station plant is practically idle so far as earnings are concerned about 70 per cent. of the time, and that in small towns people cannot be persuaded to use light at unaccustomed hours, while it is practically impossible to develop in such places a power load at profitable prices. While these conditions are not ideal with respect to the utilization of a central station equipment for heating purposes, yet the experience of the past several years in the case of numerous small stations has been that the addition of a steam heating equipment is a profitable move. Of many reports made on the results of such an addition, we cannot recall one which has been unfavorable, in every case a satisfactory profit having been shown. While the

uncertainty with respect to the depreciation of the underground piping will require some years of experience to settle, it seems now well established that a central station in a small town is not taking an undue risk when it installs a heating plant, to be run in connection with its electrical business; and it is quite possible that the future will also demonstrate that a further advantage may be derived from the addition of an ice-making plant as a complement to the heating plant. With steam heat as a by-product in the winter and ice in the summer, the smaller central stations showing a profit would cease being in the minority.

Automobile Reliability.

The recent reliability contest from New York to Boston and back, organized by the Automobile Club of America, was a brilliant success in many respects. As was to have been expected, electricity played no part in the trial, the distance being 500 miles, and the means for charging along the route being still of a very crude and unorganized character. But that is a detail of insignificance in view of the fact that no serious proposition has yet been made to use electricity for such extended trips. The American gasoline and steam vehicles engaged in the run did remarkably well, and their makers in general have every reason to be proud of them. When one considers the condition of the roads along a large part of the route, or for that matter between any two great American cities, it is simply marvelous that the vehicles should have come through so well. Out of the 75 automobiles which started on this memorable run, 67 were in at the finish in good shape, and it is understood that at least a score of them have perfect records. This compares with a similar endurance test made recently by the British Automobile Club, when only two out of 88 starters showed up with perfect records at the end of a run of 650 miles. Some day the roads here may compare with those of England and France, but meantime it is one compensation that the ill condition of the highways here, due to the rapid development of the steam road and the trolley car, has taught automobile manufacturers how to put the design and the stuff into their vehicles that will stand the worst weather and the roughest banging about.

Combined with the track records which are being made, this showing is cause for the heartiest congratulations of all who believe that the practical success of the automobile art is destined to ameliorate conditions of urban life and to improve facilities for country travel. We remain very firm in our conviction that electricity is destined to play a large part in the urban development of automobilism, but we see in this no reason for failing to rejoice at the excellent demonstration of the sterling qualities of American steam and gasoline vehicles. They are not perfection yet by any means, but they have made some tremendous strides toward it in the last year.

German Electrical Progress.

A recent bulletin issued by the United States Department of State, includes some very interesting figures by Consular Agent Harris, on "electrology" in Germany. We do not like the word very much, but the figures are valuable. It is stated in the report that there are 80 electrical engineering joint stock companies in Germany with a capital of $125,000,000, and that three of these companies employ nearly 30,000 persons. It is also stated that in 1901 these concerns exported to other countries electrical apparatus worth $3,831,690. The interesting fact is further noted that in Germany more than half the steam engines and turbines turned out are used for driving dynamos. It likewise appears that in the works of the companies named, there are 1,950 engineers employed, who are college men with technical training.

It is rather difficult to determine from these figures just how many of these concerns are manufacturing, and how many are of the consulting and constructing types. The three concerns named as employing 30,000 are, however, in the manufacturing class. The recent United States statistics on electrical manufacturing showed that there were, in 1900, in this country 580 distinctive electrical manufacturing establishments, with a capital of $83,000,000, an output of $91,000,000, and a roll of 46,000 employees of all kinds. It is obvious from the comparison which we are enabled to institute that in proportion to the capital invested, the German electrical industries employ a much greater number of hands, and from this two inferences may be drawn, and possibly three. It would certainly seem fair to assume that labor is not quite so efficient, that automatic processes are less in vogue, and probably that labor is not so well paid. These 46,000 American officials and employees received nearly $25,000,000 during 1900, and the 40,000 wage earners received $20,000,000, giving an average over the latter number of $500 per head. It is incredible that electrical labor in Germany is paid at anything like the rate indicated by these figures.

Deductions as to the relative number of engineers employed are rather difficult to make, but we might point out that the 1,950 engineers mentioned as employed by these 80 companies in Germany represent a body larger than the total membership of the American Institute of Electrical Engineers. This may not mean much, as President Scott on the basis of kilowatt capacity employed in electrical work in this country has figured, with the imaginative ability of a Col. Sellers, that the Institute ought to have at least 25,000 or 30,000 members. We are inclined to think that with so large a number of employees of the wage-earning class, the amount of supervision and superintendence in Germany is much larger than it is here. As to the figures of electrical export, we note that the German total for 1901 was less than $4,000,000. In our own country it has already reached twice that amount, and this year is between $9,000,000 and $10,000,000. It is possible, however, that the German figures given do not include some items brought to account in America, but even then the comparison is very much in our favor. Germany is the leading electro-technical country in Europe, and is our most active competitor in the broad field of the world's markets. And while we are glad to find her electrical industries show up so well, we do not think that the figures quoted are other than encouraging as to American pre-eminence and opportunity. It must not be forgotten that much of our success is due to German hands and to German minds, made welcome here.

The Armature Reaction of Alternators.

This is a fascinating and favorite theme in recent years. It has also considerable practical importance, since the regulation of alternators depends upon it. It is not so long ago that the best alternators had such large armature reaction that they could not be made to give more than about 50 per cent. above full-load current when run on short-circuit, and this fact was availed of to extol the safety of the machines and their immunity from injury in cases of accidental short-circuit. At the same time this immunity was gained at the expense of very poor inherent regulation of pressure, and much superexcitation of the field magnets was necessary in order to maintain normal pressure under inductive loads.

The modern alternator has gained in regulation, but it is no longer safe to short-circuit it with impunity. The degree of regulation under load, and particularly under a load of assigned and expected power-factor, becomes of much importance in central-station practice. Alternators are becoming larger and larger year by year, and it is

practically impossible to load them in the factory. In fact, the full load of such machines may not be found until several years after the machine has been constructed. For these reasons, therefore, any method that is reasonably simple and reliable, by which the regulation can be computed, is very advantageous as giving a criterion in lieu of the missing full-load test. There is no rigidly accurate method for determining regulation from factory tests at light load, and it does not seem as though a rigidly accurate method could be arrived at, owing to the great difficulty which surrounds the subject, and the effect of the magnetic saturation of the active iron in the machine. If it were not for the saturation of the iron, the problem would be greatly simplified.

Nevertheless tentative methods are in use which yield results that are fairly reliable, and which may be regarded as first approximations. Thus, the standardization rules of the American Institute of Electrical Engineers offer such a method. It may not be absolutely correct, but it supplies an approximation and affords a criterion by which the regulation of an alternator may be gauged beforehand. The article of Prof. Guilbert, the first installment of which appears on page 658, deals with the subject at considerable length. It treats the matter from the standpoint of a designing engineer, rather than from that of factory tests. It is, however, interesting and well worthy of study from either standpoint.

College and Professional Training.

The American college president is just now in a most embarassing dilemma. Hemmed in between the futile pottering of the elementary and secondary schools and the strenuous demands of the professional schools for more and better training, he is face to face with a most serious educational problem. The American college has been for many years the backbone of our whole educational system. Of its immense usefulness and high importance the achievements of its graduates bear witness. Of late it has often been decried by that class of our fellow countrymen which holds that a finer and more valuable ethical training is to be found in apprenticeship in a broker's office, but those who thus protest furnish their own sufficient condemnation. In our own profession such doubts are settled once for all by the action of the great electrical companies in demanding a college education in those who cast their lot with them for technical training. But we Americans are a hurrying and restless race, and too often grudge the time that it takes to make a well-grounded man or a scholarly institution. We demand of a college the celerity and concrete results best exemplified in a pork-packing establishment. But the present anomalous status of the college is due perhaps more to its own laudable but ill-judged ambition than to the pressure of the times. For many years President Eliot, one of the most able and progressive educators of this generation, bent every energy toward lifting the college by its bootstraps to the plane of the foreign university. This programme demanded that the fitting schools should play the rôle of the German gymnasia, but twenty years of industrious goading has failed to produce the desired result, and the chief effect has been to push the college into the existing dilemma. With a very few conspicuous exceptions, university remains purely a brevet rank in American education.

And now that the conditions of the times demand longer and more thorough professional training than ever before, the college is indeed hard pressed. It is crowded from above by the necessity for more time in the professional schools, and for a nether millstone it finds the secondary school that its own hands have fashioned. And truth to tell, the college is losing heart. It has virtually surrendered its last year to professional electives, but the sacrifice has not served its purpose. The latest suggestion from no less eminent a source than President Butler, of Columbia, is for a two-year college course leading to post-graduate training, and a parallel four-year course for such as may desire it. We hope this experiment may not be tried, for its success would mean the disintegration of the college as it has been, and the introduction of nothing to take its place. The American student is not fit for post-graduate university work at the end of his sophomore year, and will not be until his training in the secondary schools is more thorough and less diffuse than it ever yet has been or is likely to be for some time to come. Nor can one successfully serve two masters, college and university. If the American college is to remain a part of our educational system, it must stand by its old ideals and neither retreat nor compromise. It is capable of giving a splendid training for professional study, or in the so-called humanities, but it cannot do either in two years now any more than it could a quarter of a century ago. It cannot turn out well-grounded men by the simple process of tagging them A. B. at the end of three years, and it would do its noblest work in repressing the tendency to hurry instead of encouraging it. We grant that there have been those who found a sound education outside of college walls, but we do not believe that any man who has made a deep and strong mark on the world's progress ever regretted the time spent in his education, save in that it was too short.

We grant readily enough that there is a demand for saving of time in modern education, but in so far as it voices a legitimate criticism it had better be directed at the elementary and secondary schools than at the college. These have, partly through unwise pressure from the colleges and partly through the misguided efforts of educators who spell their title in large capitals and are so devoid of a sense of humor as to take themselves seriously, been so filled with bogus humanities and trumpery science that they have scant time left for the fundamentals of a sound education. When a child starts in a kindergarten at six, learns his letters at seven, to write at eight and the multiplication tables at nine; when he dabbles in sloyd and nature study, bad music and worse art; when he potters around three or four kinds of kindergarten laboratories acquiring pseudo knowledge which he must unlearn later—it is small wonder that he turns up a year or two late at college and hunts there for electives that will not strain his undeveloped powers of concentration. If the college would do the greatest possible service to education it should sharpen its axe, not to decapitate itself according to the present program, but to hew out of its curriculum the courses that demand a diffuse preparation in the secondary schools, and out of these latter the time-wasting requirements. The student who knows a few things thoroughly when he enters college is better fitted than he who has a smattering of many. This is the secret of the success of the German gymnasium. Its graduate may be totally ignorant of the Italian Renaissance, but he knows his Latin and his algebra. There are few American colleges that turn out men so soundly and thoroughly educated, so capable of using their knowledge and of taking care of themselves anywhere on earth, as those that don the blue from West Point and Annapolis, and there are no colleges with so simple requirements for admission. But the boy who wins his appointment in competition is pretty sure to know this little thoroughly, and in so knowing it he has the key to all that follows, and of this all, none consists of educational hobbies. If the colleges would get grimly down to work and force the elementary schools to teach less and better, they would turn out men to whom the professional schools would be no toilsome task. And with the time thus saved, we should hear no more wails of too much time spent in education. The colleges have the remedy in their own hands—if they are hard pressed, they have only themselves to thank.

The Function of the St. Louis Exposition Machinery Building.

By Charles T. Malcolmson.

THE architecture of the Machinery Building, for the St. Louis Exposition of 1904, may be characterized in general as purely classic, bordering on Italian Renaissance. It is flanked by four towers following out the general style of the building, while the entrances are treated in such a manner as to harmonize perfectly with its architecture and form quite a leading feature in the design.

The building is 525 x 1,000 feet, and is located practically in the center of the Exposition Grounds. It is one of the group of buildings of the main panorama which forms about the Art Hill as a focus. The eastern façade lies along one of the radii of approach to the Grand Basin, while the northern façade faces the main artery of travel, connecting the two natural divisions of the grounds, of which Skinker Road is the dividing line. Beginning with the western end of the building and running south and behind it is the Street of the Midway.

Certain machines belong essentially to the Machinery Building, and may be broadly divided into "machinery for the generation and transmission of power" and "machinery for making machinery." The western wing of the building will be devoted to the exhibitors' power plant and the Westinghouse plant, all exhibits used in the generation and transmission of power not included in these plants, together with items classified as "general machinery" and "fire apparatus." In the eastern wing will be placed "machine tools" for working in metal and wood, and "arsenal tools." Traveling cranes and all other facilities for handling heavy machinery will be available the entire length of the western wing, and heavy machine tools will be located in the northern end of the western wing, to take advantage of these facilities.

France, ever quick to recognize the forces at work, evolved a classification upon a new principle. The authors of our classification have but developed this idea. Beginning with the building as indicative of the department, each exhibit will follow the group and class subdivision, and must be installed in its proper class, regardless of nationality, to be considered for award. This method of installation gives the producer a chance to show, the buyer to see what is for sale in the world's market; it gives the designer the benefit of foreign ideas, the student and interested layman the opportunity to study the race characteristics as revealed in the product of each country.

The general division of floor space in the Machinery Building will be effected by two main obligatory aisles running longitudinally from east to west. In the center section of the western wing will be placed the plant purchased of the Westinghouse Company. This plant consists of four direct-connected 2,000-kw units. The engines are of the vertical multiexpansion type, running condensing, and the generators are three-phase machines, generating 25-cycle alternating current at 6,600 volts. Its boiler plan will be located in the boiler house, contiguous with the Machinery Building, and will consist of sixteen 500-hp boilers of the Babcock & Wilcox type, generating steam at 150 lbs. gauge pressure. The boilers will be automatically stoked. All accessories to complete the plant, such as pumps, feed water heaters, etc., will be furnished under the contract, together with the design of the plant and its installation.

One of the most comprehensive ideas for machinery exploitation ever conceived has been planned in the exhibitors' power plant, and the encouragement already received from prospective exhibitors on both sides of the water, augurs well for its success. This plant will include steam engines, steam turbines, gas engines, vapor engines, water motors, all forms of electric generating apparatus, pumps, pumping engines, boilers, etc. etc., as actual working exhibits in the diversity of their application. The interest will be chiefly due to the great variety of the prime movers, and the working test covering the entire operating period, upon which will be based the awards. A complete record, covering all the material elements of a test, of all boilers, engines, generators, pumps and other machines and apparatus installed in this exhibitors' power plant will be kept. This data will be collected under the supervision of a competent engineer, will be incorporated in the report of the machinery department to the United States Government, and will be published by the Government together with the awards. No such record has ever been accessible to the public before.

MACHINERY BUILDING, ST. LOUIS EXPOSITION.

The clou of the Centennial of 1876 was the Corliss engine; mammoth beyond expectancy for that period of our engineering. Chicago showed her 10-hp gas engine with pride. But the development in the last decade, in size and efficiency of these classes of engines and of steam turbines is phenomenal. It is not strange that increasing interest will be awakened in the student and layman alike, that the engineer will find here material for many hours of study in the greatest massed exhibit and variety of types ever before collected and installed as a working exhibit.

Europe is coming to the front and showing her interest in this great universal exposition by assurances to exhibit with us. Gebr. Korting, of Hanover, Germany, will install a 1,000-hp, 2-cycle gas engine; the De Laval Steam Turbine Company, of Stockholm, a 3,000-hp steam turbine, and Durr & Company, of Dusseldorf, a 2,000-hp in water tube boiler, as working exhibits. The excessive cost of fuel in these older countries has forced upon their engineers the necessity of high economies. We are prone to think that our apparently inexhaustible fuel supply will take care of our low efficiencies in prime movers, sacrificed on the altar of first cost. It is to this end that an international comparative working test of power generators will have exceeding interest to the purchaser as well as the manufacturer, for the trend of modern American practice is certainly towards better economy in the operation of power plants

The Rowland Rapid Telegraph System—II.

MANNER IN WHICH THE SIGNALS ARE RECEIVED.

SINCE the two ends of the line are in all respects alike, any description which will apply to one end will also apply to the other.

Referring to Fig. 7, L is the main line and R_a the main line polarized relay. This relay has two insulated tongues which vibrate synchronously with the alternating current waves arriving over the line L. The tongue t_s controls the synchronizer, S, which operates in the manner described above. The tongue t_b has the functions to be described. C is a "receiving" commutator, practically identical in construction with the "sending" commutator described above. Sweeping around this commutator, which has 52 segments, there is a brush, or trailer, t_p. This trailer is connected by gearing to the rotating synchronizer S, but with a speed reduction of 13 to 1. The commutator may be rotated through a small angle, giving an adjustment, so that when the trailer t_r is in the centre of a segment the relay tongue t_p is at that instant against either a left-hand or a right-hand contact. R is a resistance of several hundred ohms, to the terminals of which is connected a 110-volt direct-current circuit.

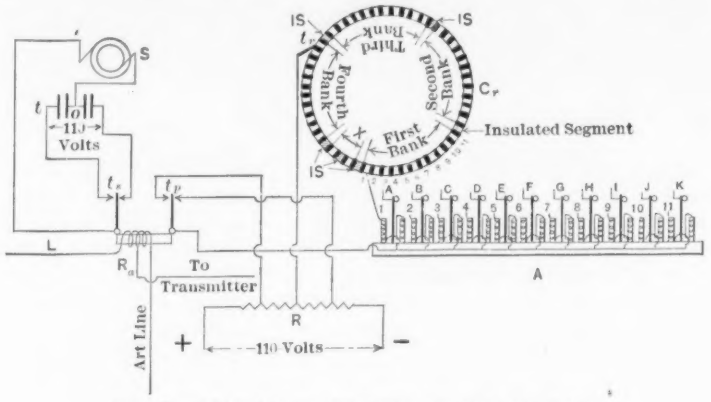


FIG. 7.—DIAGRAM OF CIRCUITS AT ONE STATION.

A is a bank of small polarized relays, called the "selecting" relays. There are, in reality, four such banks of 11 relays each. Only one bank, however, is here shown.

Each of these four banks correspond to a keyboard at the sending end of the line. One terminal of each of these relay coils is connected to a segment in one of the groups of 11 segments of the commutator C. The other terminals or "tails" of all the coils of all the relays are connected to the insulated tongue t_p of the main line relay R_a. As the tongue of this relay vibrates between its contact points and the trailer travels over the commutator segments, synchronously with the vibrating tongue, the 44 relays will receive, in succession, momentary currents through their coils. The relays 1, 3, 5, etc., of each bank will receive a current through their coils in one direction, and the relays 2, 4, 6, etc., a current in the opposite direction. Thus, the tongues of the relays of even number would receive an impulse in one direction, and those of an odd number in the opposite direction. The windings, however, of relays of odd numbers are reversed, and this makes the tongues of all the relays receive, in succession, an impulse in the same direction as the trailer passes over the segments of the commutator to which they are attached. Thus, while the current on the line is unmodified, the tongues of all the "selecting" rays will receive an impulse in the same direction once each time the trailer makes a complete revolution. These repeated impulses, together with the magnetism in the tongues of the relays, hold them against their back-stops and away from the contact points A, B, C, etc.

The cut-out wave on the line will now be indicated in the following manner: When the wave is cut out, the main line relay tongue t_p will at that instant cease to vibrate and will remain against the contact point to which the previous wave had carried it. The trailer in the meantime passes on to a segment such that, if the main line relay tongue had been carried over, the selecting relay attached to that segment would have received an impulse to take it against its back stop. Now, however, this selecting relay will receive a current through its coils in a reverse direction to what it would have received had the main line relay tongue continued to vibrate. Its tongue will, therefore, be thrown against its contact point and will remain there until the trailer has made a complete revolution. When the trailer returns to the segment to which the relay is attached, unless some wave is again cut out, the relay will receive an impulse which will return its tongue to its back-stop again.

Thus, waves which are cut out at the far end of the line are reproduced at the near end by the tongues of the selecting relays which correspond to the wave cut out, being thrown against their contact points A, B, C, etc., and there remaining during one revolution of the trailer. As each of the four keyboards at the far end of the line operates a corresponding bank of 11 selecting relays at the near end, the depression of any key of the keyboard, which cuts out two waves, will cause two relay tongues in the bank corresponding to that keyboard to be thrown against their contact points. A practiced observer could readily interpret the cut-out wave signals sent over the line by merely observing the movements of the tongues of the selecting relays. Tongues 1-3 sent over might be interpreted to mean A, 1-4 to mean B, etc., through the 45 possible combinations given above.

But in the present system these signals are automatically translated into ordinary figures and letters of the alphabet which are printed upon a sheet of paper eight inches wide. It now only remains to show how this is accomplished.

AUTOMATIC TRANSLATION OF THE SIGNALS INTO PRINTED CHARACTERS.

The page printer, by means of which 41 different characters may be printed in type, involves the following essential features:

1st. A light type-wheel of steel about 2 inches in diameter, on the circumference of which the 41 characters are engraved. This type-wheel revolves continuously at the end of a horizontal shaft, which turns synchronously with the trailers.

2d. A light paper carriage which carries the paper that is fed from a roll underneath the type-wheel when new lines are made.

3d. Devices for thrusting the paper forward to make the lines, and sideways to space the letters, and a back carriage device to return the paper to a position where a new line of printing is to start.

4th. A small printing magnet, which operates a hammer or platen which strikes the paper up against the lower side of the rim of the wheel, at the moment when the character to be printed has turned to its proper position above the hammer.

5th. A set of four polarized relays, called the "distributing" relays, which serve the purpose of making contacts at proper moments for sending current to the printing magnet to print, to a liner magnet to line the paper, to a spacer magnet to move the paper sideways, and to a back magnet which allows the carriage to return the paper to the proper position for beginning a new line.

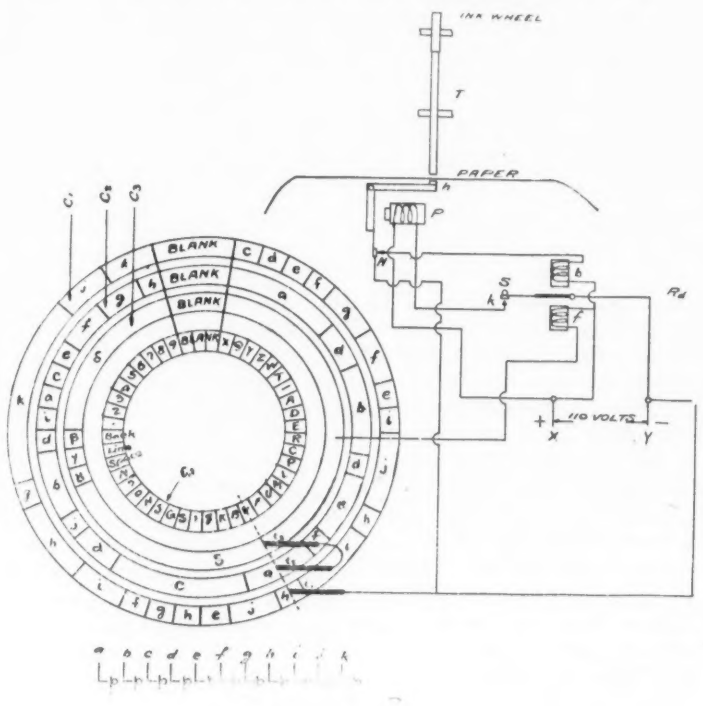


FIG. 8.—DIAGRAM OF COMMUTATOR AND CONNECTIONS.

6th. A so-called "combination commutator," the function of which will appear from the following description:

Fig. 8 shows diagrammatically the combination commutator, the

tongues and contact points of one of the four banks of the "selecting" relays, and also a part of the connections of a page printer. The combination commutator is made up of three parts or circles, C_1, C_2, C_3. Each of these circles is divided into segments of different widths with insulation between. t_1, t_2, t_3, are three brushes, or trailers, which sweep together around the commutator in the same time as the trailers on the sending and receiving commutators, and, being on the same shaft with the type-wheel, turn also with it. These trailers, as they come to bear upon different combinations of segments of the commutator, complete, together with contacts made by the relays of one of the four banks, circuits which actuate magnets that print the character and shift the paper. R_d is one of the four "distributing" polarized relays. The current, through its coil *b*, brings its tongue against the back-stop *S*, and a current, through its coil *f*, brings its tongue against the contact point *k*. *P* is a small printing magnet, which, when energized, causes the hammer or platen, *h*, to strike the paper up against the rim of the revolving type-wheel.

This is done so rapidly that the type-wheel may continue in constant rotation, although being attached to the shaft by means of a spring, it may, momentarily, pause. *X* and *Y* are the positive and negative terminals of a 110-volt direct-current circuit. The spacer, liner and back magnet, and the distributing relays which actuate them, are, for the sake of clearness, not shown in the diagram. A letter is now printed as follows: Two half-waves having been cut out of a group of waves to which the bank of selecting relays R_a belongs, two of these relay tongues are thrown against their contact points, where they remain until a reverse impulse returns them to their back-stops. Suppose contact is made with the contact points *a* and *h*, then, after a certain time, the trailers t_1 and t_2 will have arrived on segments of the combination commutator, which are respectively connected to the contacts *a* and *h*, and the trailer t_3 will then be in this case on the segment *S*. It may be noted that the inside circle C_4 shows the position of the letters on the type-wheel corresponding to the combinations of segments on the combination commutator. The following circuits are now completed. The current starting from the positive pole *X* passes through the coil *f* of the "distributing" relay R_d throwing its tongue against the contact *k*. Thence it passes to the segment *S* and out through the trailer t_3 and into the trailer t_2, thence into the segment *a* of the commutator connected to the contact point *a*. From there through the tongue of the relay and by the frame of the relays of the bank to the tongue making contact with contact point *h*, thence to the segment connected to this contact point *h*, and thence by the trailer t_1 and its connection back to the negative terminal *Y*. It may be stated, in passing, that all segments of the combination commutator are connected to the contact points of the same letter of the bank of relays R_a.

At the instant that the above occurs, the type-wheel, *T*, has turned into a position so that the letter engraved upon its rim, and which corresponds to the combination of segments *a-h* on the combination commutator, is just over the platen *h*. In this case the letter would be *V*. At the same time, contact being now made at *k*, a circuit is completed which makes the platen strike the paper up against the type-wheel and so prints the letter. This circuit is from *X* through the coil of the printing magnet, *P*, to the contact *k* and back through the relay tongue to the negative pole. At the instant, or just before, the platen, *h*, strikes the paper against the type-wheel, a contact is completed at *N* which permits a momentary current to pass through the coil, *b*, of the relay R_d, thus returning its tongue to its back-stop. A further circuit, which is not here shown, is also automatically completed, which causes the paper to shift sideways under the wheel through the distance of a space between letters, that is, "spacing up" is automaticaly accomplished.

In this manner 38 characters may be printed. Three combinations as *g-b*, *k-b*, *k-d*, are reserved for spacing, lining and backing the paper at the will of the operator at the far end of the line. The segments *a*, *y*, *b*, on the combination commutator are attached to coils of the polarized relays, not shown, which distribute current to magnets that performed the above function. If the operator at the other end of the line should neglect to send the "back signals" which returns the paper and attempts to print beyond the edge of the sheet, then the carriage will carry the paper back automatically when the end of a line of printing is reached. This, however, a practiced operator never does, because at the sending end an automatic device on the keyboard shows the operator just how far he has printed on a line.

The operator being able to space, line or back carriage at will, paragraphing, etc., can be accomplishing the same as on an ordinary typewriter.

Corresponding, of course, to each of the four keyboards at the other end of the line, is a page printer and a bank of "selecting" relays. All four of these page printers appear to be operating simultaneously.

The waves in the extra group *X* (Fig. 2) are used, one to automatically ring a bell if anything disturbs the synchronism or the printers are turned off, and one is used to "find the letter" when the apparatus is first started up. Finding the letter means bringing the trailers of the sending commutator, at one end of the line, and the receiving commutator, at the other end, upon corresponding segments of their respective commutators. For example, when the apparatus is first started up and synchronism has become established, the trailer on the sending commutator, at a particular instant, might rest on, say, the 20th segment, and that of the receiving commutator on the 50th segment, but an automatic device, operated by one of the cut-out half-waves of group *X*, will cause the trailer on the receiving commutator to lag behind until it is at the same instant on the segment of the same number as the trailer of the sending commutator. When this has taken place the two trailers continue to revolve in perfect synchronism, and always maintain the same relative position on their commutators

Marconi on the "Carlo Alberto."

Marconi, after having achieved new scientific distinction, and having royal honors conferred upon him by both the Czar and the King of Italy, is now on his way across the Atlantic on the "Carlo Alberto," to make a transatlantic test of the long-distance stations at Glace Bay, Cape Breton, and at Cape Cod, Massachusetts.

The Mediterranean trip of the young inventor, who left England on August 23rd on the Italian flagship, was memorable in many ways.

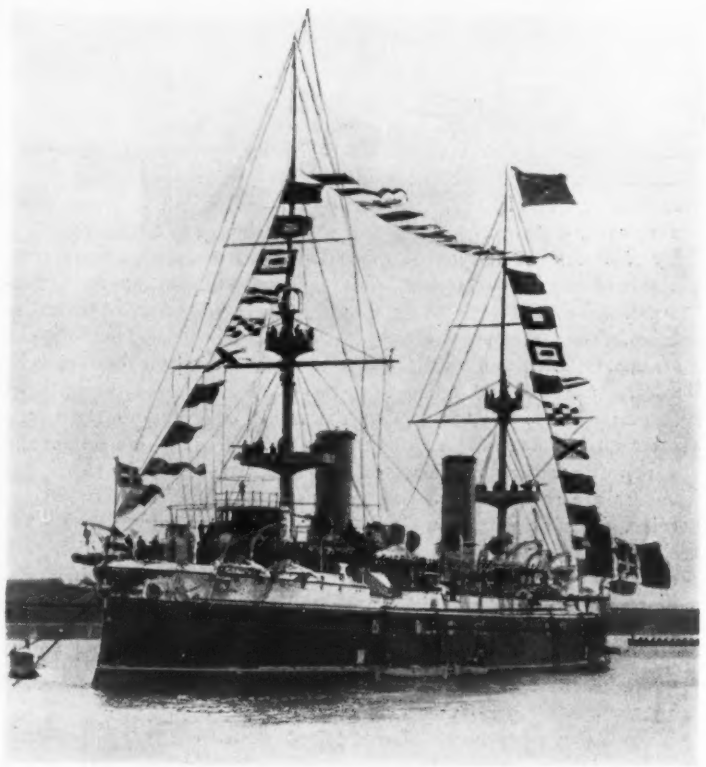
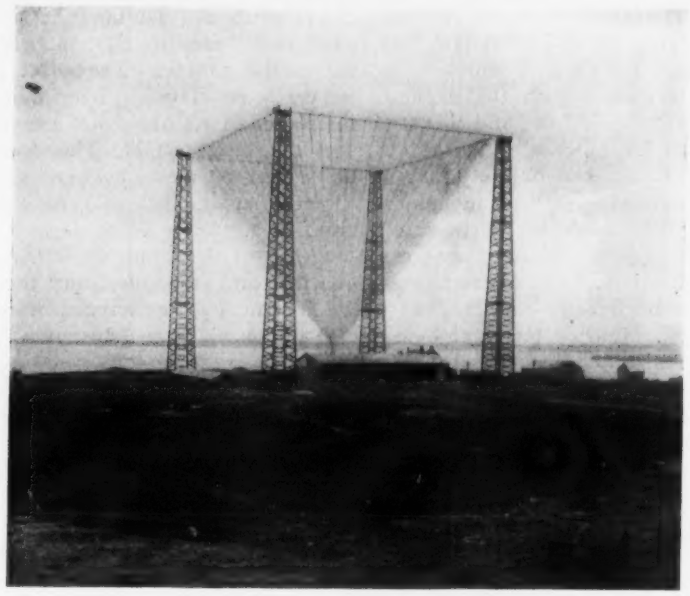
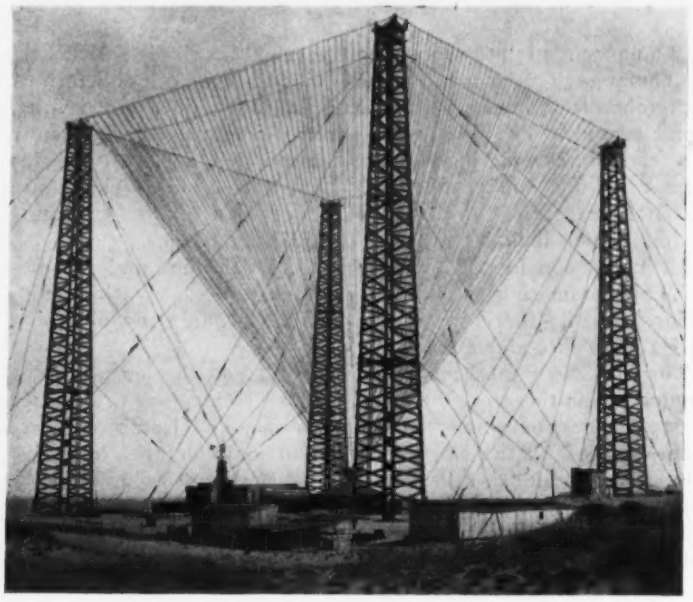


FIG. I.—THE "CARLO ALBERTO."

Throughout the entire journey he was in daily communication with the station at Poldhu, Cornwall. The last messages for the King and the Minister of Marine were received on the tape inside of Spezia Harbor. It was there that Marconi left the warship to visit the King. He had been informally summoned by two despatches from the latter, and left the "Carlo Alberto" escorted to the train by a group of admirals, commanders and other officers of the navy. While landing,

all of the crew had crowded to the masts, and, waving their hats in the air, saluted him with tremendous hurrahs and "Addio, Marconi!"





Figs. 2 and 3.—Terminal Stations at Glace Bay, Cape Breton, and Cape Cod, Mass.

During the trip, a copy of the despatches Marconi received was given equally to sailors and officers, so that everyone on board knew of any new happenings.

The experiments on the "Carlo Alberto" were intended to demonstrate that valleys, hills and mountains between the seas would not interrupt the communications. The most difficult experiment was made at Gibraltar, while entering that port and proceeding under the high fortified rock. The fog made navigation difficult, but the ship passed to anchor with the aid of the ringing of bells on the ships at anchor. Here a long despatch, relating to the Czarina of Russia, was received from Poldhu station over the Pyrenees and the high rock of Gibraltar. The series of important experiments were made under the most adverse conditions of time and locality, and all of

Fig. 4.—Marconi and Marquis Solari.

the experiments were mathematically controlled by chronometer and Greenwich time. The celebrated letter "S" call sounded the preparatory signal for a message from Lord Kelvin, which was sent to Kiel to the young inventor, congratulating him upon his success, the message reading: "Marconi, Kiel. Thanks to Admiral for permission and yourself for sending telegram of your most interesting success. Heartiest congratulations. Lord Kelvin."

The accompanying illustrations give a view of the "Carlo Alberto," taken at Cronstadt; views of the wireless stations at Cape Breton and Cape Cod, and portraits of Marconi and Marquis Solari, with whom the inventor has been working on terms of the greatest friendship.

Disturbances to Telegraph Lines by Three-Phase Railway.

By Cesare Pio.

THE Lecco-Colico-Chiavenna-Sondrio Railway, recently inaugurated in the North of Italy, is, as is well known, operated with three-phase currents at 3,000 volts, the primary voltage being 20,000 volts. The transmission lines are three wires, situated in a vertical plane and the secondary lines are constituted by two overhead trolley wires and by the rails for the return. When the first test of trains was made, the disturbances to telegraph were so great that communication had to be suspended, even that relating to the railroad service. In order to avoid these troubles the return circuit of the telegraph line was changed in direction by utilizing the stream of the Adda River. Later some inductive coils with closed magnetic circuit were connected in series with the telegraph lines, and finally a return circuit was added to all these lines. The latter was the only remedy which proved successful and gave good results.

It was also demonstrated that all the troubles were caused by the secondary current of 3,000 volts, the primary current of 20,000 volts having no influence in telegraphic communications. As a consequence of the good results obtained, the telegraph engineers of the Italian government conceived the idea of combining all the returns in a single wire; but this idea was soon abandoned, as the return of the different telegraph lines would have to be of very large cross-section. The number of wires was then doubled for all the telegraph circuits running along the railway lines. Over 400 miles of wire was laid, with all the necessary special work at crossing points, the poles were strengthened, and the whole work was accomplished in 16 days under direction of an inspector of the government telegraphs.

Some advantages resulted also from the adoption of inductive coils with closed magnetic circuit, but it was noted that the advantage was inversely proportional to the speed of telegraphic communication. Therefore, the use of such coils is not advisable with Wheatstone or Baudot machine telegraphic apparatus. The remedy just described cannot, however, be considered a complete solution of the problem, for while the change from single to double line has been possible in the present case, it would be an easy matter with respect to the main railway lines where the number of wires is enormous, and where often there are two sets of poles, one on each side of the track. Besides economical objections, there are also technical objections with respect to through lines, owing to loss of time, as was demonstrated in Lecco. The only practical solution of the problem seems to be to put underground all telegraph lines.

Tests of a 25,000-Volt Direct-Current Transmission Line Between St. Maurice and Lausanne, Switzerland.

In a paper read at the recent congress of "La Houille Blanche," M. Thury gave an account of tests made on the 9th and 10th of September last on the St. Maurice Lausanne line, 20,000 volts, direct current. The line running from St. Maurice to Lausanne is a constant-current high-tension transmission line, carrying 150 amperes with a voltage that will attain 25,000 volts. This figure will not be reached until the load develops on the Lausanne system, which includes lighting and railway service.

M. Thury considered it advisable to test the line under conditions approximating as much as possible to actual working conditions, and he therefore built a testing dynamo for obtaining 25,000 volts direct-current.

The line has a total length of 36 miles and the length of the conductors is therefore 72 miles. These conductors are carried on 1500 pine poles and 3,000 insulators. The insulators were manufactured by the celebrated Italian manufacturer of porcelain, Richard Ginori, Milan, and are of the same type as on the Paderno-Milan three-phase line, with two petticoats. The line consists of two copper conductors of 150 mm² section and a total resistance of 13.3 ohms.

The testing outfit included the 25,000-volt dynamo supplying current up to 1.5 amperes, and measuring instruments of Hartmann & Braun, included an astatic voltmeter and a milliammeter with a scale extending to 30 milliamperes, divided into 150 divisions.

The voltmeter was connected in shunt across the line from one of the two wires to the ground and the ammeter was inserted for reading the current sent from the machine. The first series of tests was made between both conductors together and the ground, connected successively with the positive and the negative pole of the machine. The time of electrification in each of the tests was one minute. The current was maintained for 30 minutes. The following are the average results of the tests.

Ten tests were made between wires at 20,000 volts, the ammeter reading being 0.013 ampere. This result was obtained in dense cloudy weather when the insulation was relatively poor, but the energy consumed amounts to only $20{,}000 \times 0.013 = 260$ watts.

If this figure is reduced to the loss per insulator, we find it to be 0.0866 watt per insulator.

In fine weather the same voltage applied showed a current of only 0.0111 amperes. The total resistance was therefore 1,802,000 ohms, and the resistance per mile, 173 megohm; energy consumed in watts 220 and per insulator 0.073; percentage of loss, 0.07 per cent.

The insulation between ground and both wires together in fair weather was found to be, at 20,000 volts, as follows:

(1) Negative pole to the line, the insulation was 0.877 megohms, or megohms per insulator $0.877 \times 3000 = 2631$ total.

(2) Positive pole to the line, the insulation was 0.740 per insulator, or $0.740 \times 3000 = 2220$ total.

In bad weather, the insulation from positive pole to the line was at 20,000 volts 864,000 ohms; at 10,000 volts 1,115,000 ohms; at 4,000 volts 1,177,000 ohms. With the negative pole to the line it was at 20,000 volts 882,000 ohms; at 10,050 volts 1,082,000 ohms; at 4,080 volts 1,180,000 ohms; at 2,000 volts 1,250,000 ohms.

These tests show that the insulation decreases with the increase of voltage, but very much less relatively to that between the conductors and the ground. This insulation includes switchboard connections of the motors, lightning arresters, etc.

The effect of polarity is also very noticeable. M. Thury emphasized the good results obtained from the tests, which as he observed, had been made on the line under service conditions.

Some of the insulators were in poor condition of repair, and an examination showed that twenty of the insulators had been broken by stones. M. Thury considers that the tests are much more important than if made on a line recently overhauled. Since the current through the insulation is so low no electrolysis is to be feared, and the power loss can be increased 100 times without reaching 1 per cent. of the power transmitted.

As compared with alternating current tests, the direct current shows higher insulation, due to the greater maximum voltage of the latter for the same effective voltage, not to mention the effects of capacity which so largely influence the results of line tests with alternating current.

A series of tests was also made on a ground return circuit. The earth resistance between St. Maurice and Lausanne, a distance of 56 kilometers, was found to be exactly 1.4 ohms, the greater part of which is located at the contact of each set of terminals with the ground, the earth resistance proper being extremely low; and this total resistance of 1.4 ohms was proved to be practically independent of the distance. M. Thury expressed the opinion that should a test be made between two terminals earthed thousands of miles apart, the total drop in volts would be of the same value.

Independent tests were made on each of the terminals for verification of the figure above given for total resistance, and these tests exactly checked, the figure for the total resistance at the St. Maurice terminal being 1.233 ohms while at Lausanne the resistance was 0.167 ohm.

The difference of resistance at these two terminals is due to the fact that at Lausanne a good lightning arrester ground was used, connected with the water conduits of the station by means of a copper wire. At the St. Maurice terminal on the other hand, the grounding was made by a connection with a set of old track rails laid in the soil near the station. The soil showed a peculiar resistivity, the potential difference at 150 feet radius from that terminal being equal to the difference of potential as far as Lausanne.

Voltmeter readings were taken to indicate the total loss between the terminals, the spare conductor being used for this purpose as a pilot wire. The drop in volts, or resistance around terminals, was obtained for each station by means of connections made to iron spikes in the ground.

Discussing ground return, M. Thury said that at first sight this would appear to be a danger, but added that the conditions in the case cited are not so favorable as in railway work for developing electrolysis. The track rails in railway work are in contact with a large extent of ground and usually they run parallel to water or gas mains. The leakage from the rails to the piping can take place over the whole distance and around the total surface of the rails in the ground. On the contrary, in the case of deeply laid earth connections which present a comparatively short length and small surface, there is but small chance of large currents going to neighboring conduits.

M. Thury advised that the earth connections be made very carefully, and not to attempt a false economy in these connections, as the corresponding line copper would in any case cost a great deal more. He advocates the use of carbon for the positive connections and iron for the negative connections.

As to the objection sometimes made to the grounding between one pole and the machine base with reference to the high potential apt to be found between the windings and the base of the machine, he said that this does not apply if the base is insulated from the ground properly, and such is the case in all high-voltage direct-current Thury installations. He added that experience has shown that these high potential differences may be easily compensated for by means of high resistances between the base and the windings, the use of which resistances is not objectionable if they are above the value of one megohm.

Telephones and Telegraphs in Madeira.

Consul T. C. Jones writes from Funchal: The last census gives Funchal a population of 50,000 people. The city is spread over a large area, stretching up and down hill, and yet it has no public telephone. The postal service is not of the best. The common communication is by note and messenger. Several of the leading business houses have private telephones. The different villages of this island have telegraph and postal communications with this city. A wire connects with the light-house at Point St. Lourenzo, 20 miles away, and gives news of approaching steamers from the north about three hours before their arrival. The local telegraph charges are 6 cents for the first word and 1 cent for each additional word. The postal service is triweekly, and the mails are carried on foot. It seems to me that here is an opening for an enterprising American. An English company got the concession for the electric light plant, and I understand it pays well.

Deterioration of Storage Battery Plates.

By M. U. Schoop.

I TRUST you will permit me to add a few words to the interesting article of Prof. A. L. Marsh, contained in your issue of September 13, and especially with reference to the statement that in a good lead storage battery (for traction purposes), the negative plates (spongy lead) last at least two or three times as long as the positive plates (peroxide of lead), I should like to make a few remarks. Speaking of stationary batteries as made by most of the Continental manufacturers, it is doubtless true that the life of the negative plates is longer than that of the positive ones, simply because the ratio of the capacity of a new negative plate to a new thoroughly treated positive plate is as 1 : 2.

If the terminal pressure of a relatively new storage battery during its discharge is divided into its components, it will be found in the case of most of the modern storage batteries that the rapid fall of pressure of the storage battery is due to the exhaustion of the positive plate. In the course of time there will be, according to the excellence of the battery, a more or less evident variation of the capacity ratio, regardless of whether the positive plates are pasted or of the Planté type. This variation means that the capacity of the negative plates becomes slowly less, beginning from the first day that the battery is operated and caused by the peculiar shrinking of the spongy lead, a fact which up to this time has never been thoroughly explained. Probably the capillary spaces in the spongy lead are closed up by the lead which is being gradually thrown down by a galvanic process—which among storage battery experts is known as "leading."

After about two years the ratio between the positive and negative capacities is no longer as 1 : 2, but as 1 : 1.5. After two more years, the peroxidation of the lead grating has progressed so far, or the active mass has become so spongy that a renewal of the positive plate is found necessary. By closely inspecting the negative plates, the active mass shows small tears, the spongy lead is disintegrated and the union between it and the lead support has become less secure. An accurate test of the capacity of the negative plates would show that the capacity is only about one-half of what it was at the beginning; and if new positive plates are now inserted, then the rapid fall of pressure is caused no longer by the giving out of the positive plates but by the giving out of the negative ones.

The above evidence I have gathered during ten years' practical experience with lighting and power batteries which had a normal use. In almost every case the life of the negative plates in stationary batteries is considerably longer than that of the positive plates, while the cases in which second positive plates are renewed while the negative plates remain in the battery are very scarce.

In the case of traction storage batteries, of which the article in question mainly treats, and in which a large capacity with a minimum of weight and space is essential, the conditions are different, in so far that the builder has no longer an interest in giving the negative plate a much greater capacity than the positive one; the space reserved for the electrolyte is very small, and for that reason a very concentrated solution must be used. Another point which must be taken into consideration is the frequent rise in temperature of the acid during the operation of the battery, which causes the sulphating of the negative plates.[1] In the case of storage battery cars in which the hard rubber jars are placed close to one another, and where there is generally no ventilation at all, I have often noted at the end of the charge temperatures of from 50° to 60° C.

The local action of the sulphuric acid on the spongy lead is least when the density of the acid is from 1.150 to 1.170 (at 15° C.). This density is the one used by most manufacturers of stationary batteries. For traction purposes, however, the electrolyte must be much stronger, on account of lack of room, and when the battery is loaded, the density is generally from 1.250 to 1.300. In this case the action of the acid on the lead is three times as great as when the density is 1.150. This in my opinion is a very important point to which too little attention is being paid by manufacturers. It is certain that in nearly all traction batteries the life of the negative and positive plates differs but little, and the problem to construct the faultless spongy lead plate for traction purposes is certainly as difficult of solution as to construct a peroxide of lead plate which has a long life.

The statement by Prof. Marsh, however (page 410), is perfectly correct, that while the sulphating can in a measure be checked by careful handling of the battery, the sulphating is detrimental to it, and that it is in a large measure the cause of the rapid destruction of the plates.

In his conclusion, Prof. Marsh expresses the opinion that future endeavors to improve the lead storage battery must be mainly in the direction of increasing the porosity of the active mass; the electrolyte must also be improved so that the formation of secondary lead sulphate (which plays no part in the current production) is no longer possible, regardless of the density of the acid.

That the porosity of the active mass determines the coefficient of usefulness of the latter—the coefficient of usefulness, meaning the relation of the active mass, which takes part in the electrolytic reaction to that of the mass which takes no part in this reaction—requires no further proof, but the transformation of a certain amount of Pb or $PbSO_2$ into $PbSO_4$ always has a definite relation to a certain amount of sulphuric acid of a definite density, as the reactions which take place on the two plates correspond to the so-called sulphate equation, the correctness of which is no longer questioned. If it were possible to completely utilize the active mass which is present (coefficient of usefulness equal to 100) instead of only about ⅓, then three times the amount of sulphuric acid would be necessary.

The prospects, therefore, of improving the life and capacity of the plates of the modern lead storage batteries may be designated as very slight.

[1] See *Zeitschrift für Elekt.*, Vienna, 1901, on "The effect of temperature rise of the acid on the capacity of lead storage batteries," by M. U. Schoop.

Strength of Flywheels.

In an article in the September number of the *Monthly Bulletin* of the Fidelity and Casualty Company, Mr. Wm. H. Boehm discusses "racing" as a cause of flywheel accidents. The formula, $S = WV^2 \div 2.56$, is given to express the stress tending to burst a flywheel rim asunder, bending stresses being neglected. As a cubic inch of cast-iron weighs .26 lb., this gives for cast-iron wheels $S = V^2 \div 10$, approximately; that is, the stress tending to burst the rim of a cast-iron wheel is one-tenth of the square of the velocity of the rim in feet per second.

From either of these formulæ it is seen at a glance that the stress in the rim of a wheel increases with the square of the speed, or, to put it another way, the factor of safety on speed is always the square root of the factor of safety on strength. If the speed be tripled, for example, the stress in the rim becomes nine times as great as before; that is, with a factor of safety of nine on strength, there is a factor of safety of only three on speed. It will be understood from this that the stress increases enormously for even a slight increase in speed.

Consider the usual cast-iron, sectional, belt-wheel having flanged and bolted rim-joints located between the arms. Such joints average a strength of only one-fifth the strength of the rim, and no joint of this kind can be designed that will have a strength greater than one-fourth the strength of the rim. If this wheel had at normal speed a factor of safety of 12 in the rim, then with joints of maximum strength the factor of safety in the joint would be only 3 on strength or 1.73 on speed. That is, an increase in speed of 73 per cent. would burst the wheel.

The wide gulf will be noted between the apparent factor of safety of 12 on strength and the real factor of safety of 1.73 on speed. This is, however, only another warning that things are not always as they seem. As a matter of fact, few wheels have a margin of safety of 73 per cent. on speed. In the accident at the Amoskeag Mills, in which a 30-foot wheel wrecked the building, killed two girls and badly injured the assistant engineer, the evidence proved that an increase in speed of only 20 per cent. caused the disaster. Many wheels in use to-day are running on a narrower margin than this.

It will now be understood why racing is so frequently a cause of flywheel accidents. Some slight accident to the governor or valve gear of the engine occurs, and away goes the wheel, causing a costly if not fatal wreck. The stress in the rim increases so rapidly with increase of speed that sound wheels, amply safe at normal speed, go to pieces without warning, and apparently without cause.

The Armature Reaction of Alternators—I.

By C. F. Guilbert.

MUCH has been written in recent years on the subject of the armature reaction of alternating-current machines—dynamos, motors and rotary converters. Most of the authors who have occupied themselves with the question have given graphical expressions for the result of their studies. The numerous diagrams thus published unfortunately do not always lead to identical results, and especially to results identical with those obtained from direct tests. Very often there is only accordance in the case of small inductions, that is to say, only so long as the magnetic flux can be considered proportional to the magnetomotive force which produces it. Accuracy requires that in addition the diagrams shall take account of the increase of stray field flux, due to the presence of current in the armature.

It is true that some diagrams have been established taking into consideration higher saturations, but nevertheless limited to the armature magnetic circuit not approaching saturation, the field-magnet circuit alone being saturated. Most of these diagrams are based on one or on two hypotheses, relating to what M. Blondel has named "transverse reaction," or reaction due to the current in phase with the vectorial direction of the no-load e. m. f. This hypothesis, which has been accepted by some and rejected by others, is in reality only admissible in certain particular cases rarely found in practice. It has seemed to the writer that it might be useful to discuss, not all the diagrammatic methods thus far proposed—which would carry us too far—but to classify them in a small number of groups according to similar qualities or similar defects, and to consider them in this form, laying stress more particularly on those which approach nearest to exactitude. First, there will be established in a rigorous manner some important formulas, most of which have not heretofore been published.

I.—Mean Direct and Transverse Armature Magnetomotive Forces.

In any single-phase or polyphase alternator the magnetomotive force at a point of the armature is a periodic function of time. This function in itself plays only a secondary rôle in the study of alternators. What it is important to know is not only the distribution of the magnetomotive force in the gap and its variation in the function of time, but especially its distribution at the pole faces as viewed by an observer carried therewith, and particularly the mean value of that distribution for a half period.

It is this mean value which defines approximately the number of supplementary ampere-turns necessary to be added to the field to compensate for those of the armature, and which permits of the determination of the armature flux between no-load and a given load, whether for the same flux in the field or for a constant excitation.

The knowledge of this mean or equivalent magnetomotive force is not, however, sufficient. As has been shown by Blondel, the action of the armature ampere-turns gives rise not only to a direct reaction, but also to a transverse reaction, the effect of which is to retard the instant of maximum field flux without modifying it in value, at least if the armature teeth are little saturated.

The first or direct reaction is produced solely by the component of the induced magnetomotive force in quadrature with the direction of a vector representing the voltage at no load; and the secondary or transverse reaction is due to the component in phase with the same vector. These two reactions will be taken up in turn, commencing with direct reaction.

Magnetomotive force equivalent to the ampere-turns of the current in quadrature.—The evaluation of the ampere-turns, or, to use the expression of Blondel, "the ampere-turns equivalent to the ampere turns of the wattless current" has been made by several writers. Besides the old formula[1] still employed by some engineers,

$$F = \frac{m}{2} NI\sqrt{2}, \qquad (1)$$

(in which m is the number of armature phases, N the number of turns per pole and per phase, I the output assumed to be entirely wattless, and F the equivalent magnetomotive force in ampere-turns), there have been given formulas somewhat more rigorous. Such are those of Kapp, Arnold and especially the tables of Blondel. The formulæ of Kapp, which are given without demonstration, and those of Arnold, are approximately the same. If designating by a the peripheral difference between the axes of two poles, and by b the width of the polar surface, the formula of Arnold is in the case when the e. m. f. curve is sinusoidal,

$$F_1 = m\frac{\sqrt{2}}{\pi}\, k\, \frac{sin\ \frac{b}{a}\ \frac{\pi}{2}}{\frac{b}{a}\ \frac{\pi}{2}} \qquad (2)$$

If the current is dephased with relation to the no-load voltage by an angle, Φ, it is evidently necessary to modify the value of F in formula (2) by sin ψ.

Kapp assumes the factor k as equal to unity. This factor takes into account the width of the induced coils, and is nothing else than the reduction factor of the resultant e. m. f., in that the two conductors of a small coil are the seat of dephased voltages of a value differing by half a period.

Its value in the formula of Arnold is, in the case of a single coil wound in two slots,

$$k = sin\ \frac{b'}{a}\ \frac{\pi}{2},$$

b' being the distance between the axes of the two consecutive slots.

The formula of Arnold, though quite mathematically exact, is not absolutely rigorous, for the reason that it is not the real value of the field which should intervene in the expression of the equivalent ampere-turns of the armature but the width where it enters the armature, of the spreading flux from the pole surface, a width dependent upon the gap and the form of the polar surface, and which always approaches the distance between the poles except when the width is quite small (less than about .6); or for fields with projections, and armature coils lying very near to the gap.

This width is deduced immediately from the representative of the lines of force on the drawing of the machine. A purely mathematical demonstration, however, will be given of the Arnold formula. The formula to be established will permit of the calculation of the equivalent magnetomotive force of the armature in every case. There will first, however, be considered the case of a single-phase machine, that of a polyphase machine being derived directly therefrom.

[1] Formula (1) is derived by supposing that for each phase the armature acts as if there were along its periphery a constant magneto-motive force equal to half the maximum ampere-turns of the armature, $NI\sqrt{2}$. This hypothesis is based upon the theorem of Leblanc which decomposes an alternating magneto-motive force of fixed direction into two constant magneto-motive forces, one revolving in the same sense as the armature and the other in the opposite sense and which may be annulled more or less by the damping effect of the mass of the field. It is thus only rigorous in the case of single-phase alternators provided with a practically perfect damper, such as the Leblanc damper, by a perfect damper being understood one whose resistance is negligible with respect to self-induction. For the other cases it is necessary to take greater or less account of the effect of the magneto-motive force revolving in the opposite sense.

Western Union and the Railroads.

The fight between the Gould and Cassatt interests opened in earnest at Pittsburg last week, when the Western Union Telegraph Company, a Gould corporation, filed a bill in equity against the Pennsylvania Railroad Company to restrain the defendant from taking away from the Western Union the right to use the telegraph lines along the Pennsylvania tracks. The plaintiff avers that the removal of its lines by the defendant was in violation of the contracts between the two companies, and that the Pennsylvania Company is without authority in attempting to terminate the agreements by serving notice, as it did in June, 1902.

The original contracts under which the lines were operated were made in 1853 and 1859, and the plaintiff asserts that they are still in force, and that the action of the defendant is in violation of them. The bill says that the termination of the agreements by the defendant, as set forth in the notice of June 2, 1902, and the forcible removal of the Western Union Telegraph lines by the defendant as threatened, "is contrary to the stipulations and obligations of said contract, and is contrary to and will be destructive of the rights of your orator, and work irreparable loss, damage and injury to your orator, to the public and to the United States, which could not be compensated in money."

It is held that a grant by the United States to construct and maintain telegraph lines on the Pennsylvania Railroad was made upon a full-valuable and continuing consideration, paid and rendered by the Western Union to the United States. The bill sets forth the Western Union Company owns and operates 192,000 miles of poles and cables, 900,000 miles of wires, has 22,000 offices, and transmits 69,000,000 messages yearly.

Predetermination of the Conditions of Operation of Dynamos, Picou Method.

Referring to the following diagram, and using Hopkinson's notation, the no-load effective flux is $\phi_u = f(4\pi ni)$. Calculating the flux we have to produce under load, Mr. Picou gives the following formula:

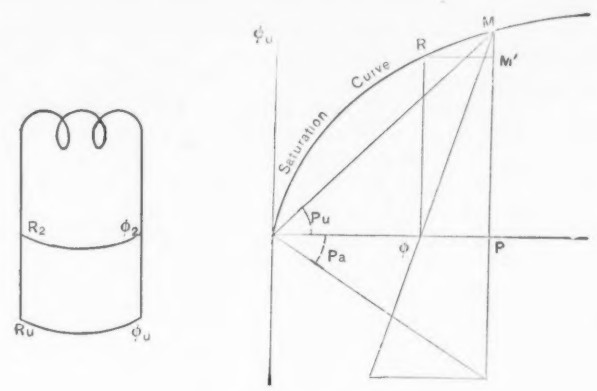
$$\phi_u + P_2 P_u \frac{1}{P_u + P_2} (4\lambda m I) = f\left(4\pi ni - \frac{P_u \lambda m I}{P_u + P_2}\right),$$

which is similar to Hopkinson's well-known formula:

$$\phi_u + \frac{v-1}{v} 4\lambda m I = f\left(4\pi ni - \frac{4\lambda m I}{v}\right).$$

From the armature no-load saturation curve, Mr. Picou plots the load curves by the construction shown in Fig. 2, which applies to direct-current machines as well as to alternators.

Mr. Picou shows a graphical determination of the cross magnet-

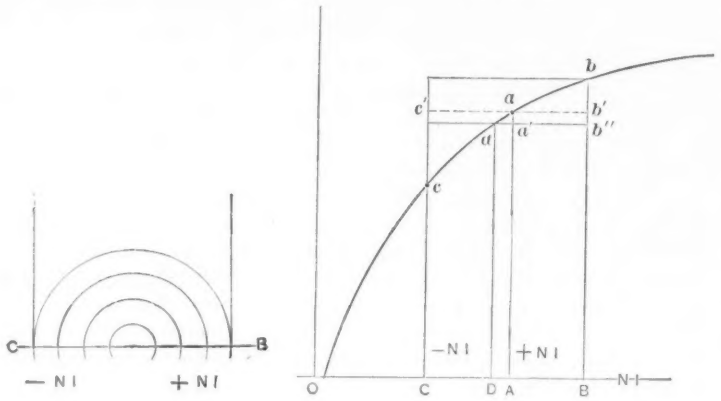


FIGS. 1 AND 2.

ization of the machine under load and its effect for reducing the effective flux ϕ_u. He assumes the transversal flux from the armature crosses the pole piece as represented in Fig. 3.

In Fig. 4 the curve *Oa* represents the saturation curve, and *Aa* is the average flux or induction corresponding to the ampere turns *O A*.

The half width of the pole *A B* is overexcited by the ampere-turns *N I*, and the flux of the half width *A C* is weakened by the ampere-turns *N I*. The part *A B* is more saturated, and the flux ϕ



FIGS. 3 AND 4.

(*N I*) represented by the triangle *abb'*, is less than the flux ϕ (— *N I*), represented by triangle *acc'*. Thus the total flux is $\phi + \phi(N I) + \phi(-NI) < \phi$.

Mr. Picou gives a construction for the final flux *D d*, consisting in lowering down the ordinate line *b'c'* till we have equal areas for both triangles *ab'b*; *ac'c* (Fig. 4). *dbb''* = *dcc''* final flux = *Dd*. The ordinate line *b'' c''* cuts *Aa* at *a'* point; *A a'* = *D d* = final flux; *a A* = initial flux; *a a'* represents the loss of flux, ϕ_{u_s} due to the cross magnetization.

The diagram of alternator armature reaction shown by Mr. Picou is similar to Blondel's and Potier's well-known diagrams. An actual application of the method has been made in well-known cases, including direct-current machines tested by Hopkinson, and the drops of voltage have checked exactly with the tests.

The case of Leblanc's alternators has shown a relative harmony between graphical determination and tests. Mr. Picou considers Leblanc's alternator as one of the most complex machines ever built, the calculations of which are greatly complicated by the presence of its field damper circuits. Most of practical cases, therefore, will check with a much greater accuracy.

Irrigation Electric Power Pumping Plant in Utah.

BY C. W. ARTHUR.

One of the largest pumping plants in the world, and probably the largest using electricity as a motive power, has just been completed on the shores of Utah Lake, in the State of Utah.

Utah Lake is situated some 30 miles from the city of Salt Lake, and has an area of 93,000 acres. Its principal sources of supply are the streams flowing into it from the American, Spanish and Provo's Canyons, its only outlet being the Jordan River, which flows north and empties into the Great Salt Lake. The waters of this river are owned and controlled by five large and several small canal companies, who furnish water for irrigation purposes in the Great Salt Lake Valley. By agreement with the owners of the land adjacent to Utah Lake, these companies have the right to raise the water flow to a point 3 feet 1 inch, known as a compromise level, above the low-water mark. At present the lake is 3 feet lower than that point, as a result of which the discharge is less than 75 cubic feet per second; this is insufficient to supply the demands made on the several canal companies. In view of these conditions, which prevail during the irrigation months of June, July and August, the several canal companies united and installed a pumping plant at the head of the Jordan River, for the purpose of lifting the waters of the lake into the river, and thence into the several canals.

At the outlet a tight dam was built, and here upon a pile and timber foundation the pumps were placed. The plant consists of four 40-inch special, low-running, double-suction centrifugal pumps, of the Byron-Jackson type, weighing about 12 tons each, fed with a suction of 40 inches, terminating in a 48-inch discharge. Each pump has a pumping capacity of 100 cubic feet per second under a head of 5 feet 5 inches, which is equivalent to a flow of about 65,000,000 gallons every 24 hours.

Each pump is independently driven by a 100-hp Westinghouse induction motor, operated at 5880 r. p. m., and is provided with an auto-starter. The power for the operation of this plant is furnished by the Salt Lake City Water and Electric Power Company, whose plant is situated some 12 miles distant, in the Jordan Narrows—the canal companies controlling the pumping plant agreeing to furnish to the electric company for generating the power to operate the pumping plant, one-third of the amount of water in excess of the natural flow of the river.

Power is transmitted to the plant at a potential of 16,000 volts, and is delivered to the motors through three Westinghouse step-down transformers of 175 kw each. Current is also furnished a 3-hp motor for the priming of the pumps.

The pumping plant is about 900 feet from the lake outlet. A new channel has been dredged for the river, the pumps are placed directly in the channel on a platform built of piles as a base. A tight dam was constructed across the river, and the water is forced through this dam, the pumps raising the water in the river at their outlet about 3 feet higher than it was at the intake. As the lake level becomes lower the difference in the levels will be increased. Six large gates just west of the pumps prevent the water from flowing back into the lake, but may be raised when the lake level is higher and let the river take its natural flow.

The plant was installed under the directions of F. C. Kelsey, civil engineer for the canal companies.

What Arco Thinks.

A cable dispatch from Berlin to the newspaper press says: Count Arco, one of the inventors of the Slaby-Arco system of wireless telegraphy, has been appointed one of the delegates to attend the international conference on wireless telegraphy proposed by the German Government. Count Arco says the adoption of international regulations for wireless telegraphy is entirely practical from a technical point of view. The Slaby-Arco Company will soon erect a station in France, in order to receive messages from Atlantic liners.

Eighth Annual Meeting of the Ohio Electric Light Association.

The eighth annual meeting of the Ohio Electric Light Association was held October 14, 15 and 16, at the Chittenden Hotel, Columbus, and was by far the most successful meeting in the life of the Association. The attendance numbered about 75, and 24 new members were admitted by election. On Tuesday evening the Columbus Edison Company and Erner-Hopkins Company gave a theatre party, an entire section of boxes having been reserved for this purpose at the Empire Theatre. Other entertainments provided by the local committee were an electric automobile excursion and a luncheon at the Country Club. Following are the officers elected for the ensuing year:

President, A. W. Field, Columbus, Ohio; vice-president, S. M. Rust, Piqua, Ohio; secretary-treasurer, J. H. Perkins, Youngstown, Ohio; advisory committee, D. L. Gaskill, Greenville, Ohio; E. J. Bechtel, Toledo, Ohio, and Samuel Scovil, Cleveland, Ohio Executive committee, E. H. McKnight, Middletown, Ohio; George Matt, Lancaster, Ohio; F. E. Valentine, Urbana, Ohio; W. F. Hubbell, Wauseon, Ohio, and A. C. Blinn, Sandusky, Ohio. Finance committee, George Hayler, Jr., Van Wert Ohio; W. F. Raber, Mansfield, Ohio, and John Miller, Springfield, Ohio.

In the absence of President White, the meeting was called to order, on Tuesday, by Vice-President E. H. McKnight, of Middletown, who presided over its deliberations and contributed materially to the success and interest of the sessions. The address of Mr. McKnight, who is at the head of two electric light plants—in Middletown and Bowling Green, respectively—and president of an electric railway line, was full of practical suggestions as well as recalling some interesting reminiscences of the formation of the Ohio Association. While fully alive to the interests of the stockholders of companies and keen to perceive and adopt every suggestion looking to increased efficiency of operation and economy of cost, Mr. McKnight believes that the way to make friends of the people is to treat them as if they were your friends, and this policy he endeavors to carry out. He urged that in order not to be subjected to unnecessary annoyances, electric lighting companies be encouraged to give the very best possible service at the least cost to consumers, that a reasonable return for their capital invested and risk assumed will admit. Mr. McKnight advocated a strenuous campaign toward having a commission appointed similar to the railroad commission, or securing the passage of laws relating to central stations modelled after those of the State of Massachusetts.

Mr. Edward Yawger, of Westinghouse, Church, Kerr & Company, read a paper on "The Present Development of the Steam Turbine," accompanying it with blue prints illustrating a number of tests made on a 400-kw turbine. He gave a general description of the design and principles of the machine, and its great mechanical simplicity, as compared with the modern reciprocating engine, pointing out that the governing mechanism is not called upon to control the steam in any way after it has passed the admission valve, and that mechanism can be very simple and only remotely connected with the turbine itself. For the turbine there was claimed increased economy, better regulation, smaller repair and maintenance account, and reduced installation cost as compared with a given standard of economy; also smaller percentage of depreciation.

The paper elicited much interest, the discussion taking the line of requests for further details as to how small turbines could be manufactured, variation of efficiency with varying load, relative speeds, etc. Mr. Yawger stated that it was easier to run a steam engine in parallel with a turbine than with another steam engine. In reply to a query by Mr. McKnight, the author stated that he thought the comparative cost of a 400-kw turbine and that of an engine of high grade and same capacity would be very nearly equal, although the less cost of foundation and building required would tend to bring down the cost below that of a reciprocating engine plant. The installation would be cheaper all along the line in the case of the turbine.

The topic following was: "On What Lines Shall We Reach New Business to Improve our Load Curve and Increase our Net Earnings?" Papers on this question were submitted by Messrs. E. J. Bechtel, superintendent of lighting, Toledo Railway and Lighting Company; Mr. Geo. Hayler, Jr., manager, Van Wert Gas, Electric Light and Power Company, and Mr. L. G. White, superintendent electrical department, Columbus Edison Company, and were followed by general discussion. Mr. Bechtel contended that gas being a concededly cheaper illuminant (Mr. Bechtel comes from a natural gas city), the effort should be to increase the efficiency and reliability of the electric service to such a degree that people will not be tempted to forsake it because of accidental break-downs and establish habits of using gas which may cling to them thereafter. In determining rates of charges for a station operating different systems, the respective load curves should be considered separately rather than the station load curve as a whole. That system of charging which stimulates long-hour burning is best. In Toledo a systematic method of employing card indexes is practiced so as to keep track of the conditions with different consumers; this the contract department has access to. This department should be in the hands of courteous, enthusiastic and business like men, who have at heart both the good of the consumer and the company. This department should keep in close touch with architects' clubs and individual architects. Mr. Bechtel advocated judicious advertising, souvenir novelties, etc. The credit and contracting departments should be in no wise connected. Meters should be properly looked after and maintained.

Mr. White, of Columbus, urged personal soliciting. In towns too small to admit of the time of one man being solely given up to this feature, some certain portions of his time should be set apart for this. The most desirable load curve for daylight hours is the motor load. Electric elevators are good business. Many small shops can be secured which do not at present employ power, and when power is introduced they will probably use more and more light on dark days, when otherwise it would not be employed. The load curve can be materially improved by the substitution of the enclosed arc lamp in place of the incandescent lamp. Where a shopkeeper has, say, a dozen incandescents, he will turn on every other one during a part of the burning hours; whereas if the arc is installed of capacity equalling the aggregate of incandescents, it would be turned on at first and kept on all through the period. Attention should be paid to the matter of rates.

In the discussion following, Mr. Bechtel said he thought there was more lost in poor contracting and in consumers that are not secured because not solicited properly, than in any other part of the system. Mr. Perkins held that in many cases it would be possible to suit a customer with respect to rates providing his wants varied from the usual lighting hours. In Youngstown a card system was maintained of agreements and special arrangements to suit certain conditions, so that when any one else had to take the same matter up, he could approach it sufficiently informed. They had in his city accomplished much by supplying railway service; electric elevators and machine shops had also proved profitable sources of revenue by the use of single-phase current and it would have been almost impossible to give service in some outlying districts with any other system.

Mr. Fairbanks incidentally referred to the case of the Farrell Foundry and Machine Company, of Ansonia, Conn., where it had been found that an exhaust steam heating plant for the works could be combined with an electric drive with just one-half the boiler installation that they had employed for a high-pressure heating system. The discussion then took a side line, referring to the subject of steam heating and hot water heating, which was taken up the day following under the regular assignment. It here developed that Mr. Gwynn and Mr. McKnight differed totally in their ideas as to charging or estimating cost of heating, Mr. Gwynn holding that it was policy to heat only one room if a consumer desired only that, and Mr. McKnight's plan being to require the consumer to take heat for an entire residence. Mr. McKnight employs thermostats, while Mr. Gwynn does not, but practically makes his plant a thermostat for the entire system.

Mr. Colwell wished to know if any one had an appreciable load from electric cooking, and if that would ever amount to anything. Mr. McKnight stated that he had cooked flapjacks on an electric stove in competition with a coal stove and he had his on his plate some minutes ahead. He was asked if he had made any estimate of comparative cost, and replied that he had not treated that matter seriously. A gentleman present reported that in Traverse City, Mich., the current had been used to some extent for chafing dishes, etc., and that bills that had been $2.50 ran up to $5 and $6 a month. During some months of the year this might be a profitable branch.

Mr. McKnight again called attention to the value of introducing current for any other purpose as stimulating its use for lighting, since if on the premises its great ease of use would tend to its use for light. He had in Middletown a number of electric sadirons taking current.

and heard no complaint on the score of cost. Mr. Bechtel reported that electric curling irons are employed in Toledo to some extent, and also warming tables and sadirons. It was very handy to heat water in a sick room, etc. Mr. Raber, of Mansfield, gave a special rate for electric automobiles provided they were not charged during the peak, and had found this profitable business. Mr. Bechtel reported the same experience, his rate being 3 cents per kw-hour. Mr. McKnight several years ago adopted the plan of furnishing lamps, but now thought it bad policy. He now held it better to charge for all supplies. It was objected by some that if the consumer bought his own lamps he might buy a poor article and indirectly reflect upon the quality of light furnished, but Mr. McKnight in such case felt his own conscience was clear.

Mr. Perkins mentioned a case where a certain manufacturer who had a good many renewals, thought he could buy his lamps cheaper, and did so, but the lamp used so much more current that it proved a losing speculation, and the manufacturer was glad to purchase thereafter of the company. Mr. Raber reported that having had trouble with excessive lamp renewals, close track was kept of renewals for a considerable period, and after ascertaining the percentage, the price of current was increased sufficient to cover that item, and it was now no longer a matter that concerned them. They sold their lamps at cost in some cases; in others furnished them free on renewals. Mr. McKnight saw no objection that could reasonably be urged to making a fair charge for all material supplied consumers; otherwise the station would lose.

On Wednesday morning, the first subject for discussion was, What is the present state of meter development? How shall we handle our meter department to obtain (1) least cost of operation; (2) least disturbance to consumers; (3) maximum efficiency?

Papers on the subjects were presented and read by Messrs. F. G. Vaughan, of the General Electric Company, Lynn, Mass.; H. P. Davis, of the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa., and Mr. F. J. Alderson, of the Stanley Instrument Company, Great Barrington Mass. On the part of the central stations, a paper was presented by Mr. E. H. Beil, of the Youngstown Consolidated Gas and Electric Company.

Mr. Vaughan after pointing out the various kinds of meters that could not be obtained for various purposes in the open market, said that the behavior of meters should be studied with reference to varying conditions, such as variation of frequency, variations in voltage, different conditions under inductive and non-inductive and mixed loads, and also when current is supplied from different types of machines affecting the wave forms. The longest life compatible with efficiency is important. Laboratory tests are not alone sufficient, but meters should be tested carefully under actual conditions of service. Annual inspections were necessary. The author considered methods of testing, and contended for inspection upon premises in all cases. Manufacturers, he stated, are giving the meter problem close attention with a view to securing the best results for all concerned.

Mr. Davis's contribution to this question was entitled, "Some Pertinent Features of the Modern Meter." After referring to the excellence to which the modern meter has been brought by manufacturers, it was pointed out that the causes which preclude permanency are: (1) Aging of the permanent magnets; (2) Variations due to changes of voltage, temperature, frequency, etc.; (3) Wear upon the bearings. Manufacturers fully realize these difficulties, and are bending every effort to meet and remedy them. Friction is the most important source of error, as resulting chiefly from the weight of the moving part and consequent wear. His paper considered this element of friction in some detail, and its causes; also the relation which torque bears to the friction as affecting accuracy of the meter. He strongly advocated the importance of a high ratio between torque and friction, this to be obtained by minimizing friction through keeping the weight of the moving elements at as low a figure as permissible for strength. He described a new cup and ball bearing, which his company has introduced to fulfill this condition, and the superiority of which it is claimed tests made at the engineering laboratory of the Westinghouse Electric and Manufacturing Company have demonstrated.

Mr. Alderson's paper while not directly referring to the Stanley meter, enumerated points of excellence that are claimed especially for it. The writer maintained that every meter should be tested before it is put upon the line, and the manufacturer held to his guarantee if the meter fails to respond to test. It is a prevalent custom for electric companies to adopt a meter for testing purposes of the same make as they are using on their lines as a standard. This is not good practice, for the same meter may be developing faults peculiar to that make, and consequently lost sight of. Undoubtedly, the best method of test according to the author is to use an indicating wattmeter in series with the recording wattmeter to be tested. Testing by "tested" lamps is unreliable for close results. The results secured by magnetic suspension were referred to and commended, and the importance of the most accurate meters in removing causes of dissatisfaction on the part of consumers was emphasized.

The discussion on this subject was somewhat long, and developed variation in practice among station managers, some holding that meters should remain permanently in adjustment without necessity for frequent inspection. Mr. Field considered that this was as unreasonable as if a man were to expect his watch to remain a good timekeeper without being given a periodical cleaning and oiling up. Mr. Perkins said that at his station a card index was kept of meters, and if variations in bills occurred which could not be accounted for otherwise, the meter was at once examined and inspected, without waiting for the customer to complain; so far as possible complaints were anticipated, and their cause inquired into in advance. Many of his customers were in the habit of sending notice to the office if an extra amount of light would be required for an especial occasion. By keeping track of this it was often possible later on to reconcile the increased bill satisfactory to the consumer.

Mr. E. H. Beil, of Youngstown, in his paper stated that inefficient meters are a constant source of dissatisfaction and loss of custom. Meter cases should be well made, stiff and dust-proof, and should require the minimum amount of skill in installing. Terminals do not receive sufficient attention from manufacturers, and should be made heavy and have at least two good screws for securing the wire in same. Meters should be so set that the heat generated by a poor contact will not destroy the entire meter. Means of adjustment should be provided so that the meter may be easily calibrated. The moving element to be light as possible, and sliding contacts minimized. In Youngstown a test room has been established, with both alternating and direct-current instruments for testing. The stop-watch method is used, and a running test sometimes made to determine whether the recording dial is all right. All meters are tested when received from manufacturer; and thereafter, as may be found necessary by occurrence of variance in consumers' bills, etc. No regular inspection is made. Twelve hundred meters are installed. Of 800 of one make in use, some 50 required repairs to shafting or jewels, etc. Of a lot of another maker, received about 18 months ago, none have required any repairs. Thirty meters of still another type installed gave the most trouble, but a comparison of these as used on a 500-volt circuit would probably be invidious as they are then operating under altogether different conditions.

At the invitation of Prof. F. C. Caldwell, of the Ohio State University, the Association visited that institution on Wednesday evening. An address was delivered by Prof. Edward Orton, Dean; Prof. Embury Asbury Hitchcock, M. E., professor of experimental engineering, and Wm. T. Magruder, M. E., professor of mechanical engineering, also assisted in receiving and entertaining the visiting body. Among other objects of interest, a Nernst lamp installation was shown in operation. A number of students from Prof. Caldwell's class in engineering attended the sessions of the convention upon invitation, which, by vote, was extended to the faculty and students.

Wednesday afternoon the business of the convention was devoted to legislative matters referring to a proposed municipal code, and the proposed repeal of an arc light bill passed at the instance of the railroad companies. This was followed by papers and discussion upon hot water heating as an adjunct to electric lighting plants, a topic to many of the station managers of growing importance and in which they were greatly interested.

Acting President McKnight, of Middletown, submitted the first paper on this subject, the opening sentence of which furnishes the keynote to its contents. Mr. McKnight says: "Owners of electric lighting plants have long desired to increase the earning capacities of their properties without appreciably additional expense. This has led to an investigation of the utility of exhaust steam as a means of heating buildings. Wherever this business has been added to an electric light plant it has proven its salvation, especially where

competition has been keen and profits small." This paper will appear in full in a following issue. The information it gives is especially applicable to smaller cities, but not too small to permit of a fair day-load, or where a day-load can be created.

Mr. E. F. Gwynn, of the Delaware Electric Light and Power Company, followed, and gave a detailed description of his method of installing the heating system, construction of trenches, laying of pipe and properly covering and protecting them. In the discussion following, Mr. Gwynn stated that his company had during the last winter and covering the twelve months then ending, paid a coal bill of $6,800, and sold heat to the amount of $7,800, with an increased operating expense in coal bill over the previous year when the system was not in use or installed of something like $1,000. In the heating plant proper there was represented an investment of some $32,000. There must also be considered interest on this investment of some $1,600. The average horse-power last winter was 190 for the day; there are up to 425 horse-power installed. Mr. Hayler, of Van Wert, reported that they were selling heat, and had to use live steam at times last year, simply because they had no day-load. The coal bill for five months from the 25th of November until the close of the season was increased not quite 50 per cent. If they could operate the lighting plant continuously for 24 hours they could afford to sell their current at a sufficiently low price to pay for fuel; then the gross returns from heating would be net profit.

Mr. Hoit, of Cleveland, held that where it is possible to secure water for condensing, and particularly in plants where they have no day-load, a better revenue could be secured than by attempting to use exhaust steam for heating purposes. If it is possible to maintain a day-load on the plant equal to a light load, so that the plant will be in operation for 20 hours out of the 24, the advantage gained by using the exhaust steam for heating is about the advantage gained in condensing. However, the cost of the investment on installation for heating purposes must be considered as a matter of expense to be charged against the heating system as compared with a condensing plant.

On Thursday morning, at request of Vice-President McKnight, Mr. D. L. Gaskill, of Greenville, took the chair and presided during the remainder of the meeting. Mr. C. R. McKay, of the General Electric Company, Lynn, Mass., presented a paper on the topic, "What is the reliability, regulation, power factor and efficiency of present forms of alternating-current series arc lighting apparatus?" with reference to constant-current transformer systems. Following this a paper by Mr. Thomas Spencer, of the Helios-Upton Company, Philadelphia, was read by the secretary, which devoted especial attention to the inductive regulator and step-up transformer system. He thought that the most important question to be considered in connection with the subject was the relative advantages of differential and shunt lamps for use on alternating-current circuits. He was of opinion that the shunt lamp does not materially assist the regulator, and that the differential lamp would avoid the danger of "pumping." Carbons are together in the differential also when the lamp is not burning, and the cut-out is mechanical and can be made very simple, thus assisting the reliability of the system. On account of the presence of the series coil in the differential lamps, the terminal average is necessarily higher than that of the shunt lamp, and more than that, it is not possible to change the current on the line without readjusting differential lamps, which can be done with the shunt. The system considered shows up a very good efficiency of 95 per cent. Where transformers are used this efficiency is lowered to about 91 per cent. To a certain extent the efficiency decreases when the system is operated at less than full load. On the whole, series alternating-current arc systems, as now operated, are in every way a commercial success, and will certainly grow in favor as time goes on and the good points are better understood.

Mr. W. A. Layman, of the Wagner Electric Manufacturing Company, St. Louis, next presented a paper on variable secondary step-up transformer systems. In the discussion, Mr. Bechtel, of Toledo, reported very good results with three 100-light transformers in operation for one to two years and a half; service reliable and no repairs. Their experience had taught them it was better to burn up lightning arresters in the station than cable outside that could not be so easily repaired. Three hundred alternating and 75 direct-current enclosed lamps were taken care of by one trimmer with a wagon equipment and trays. In the summer, the lamps are trimmed once every five days; in fall and spring once every six days; in summer once every seven days. He desired to know of the supply men what impedance is absolutely necessary in a circuit to insure steadiness of light. Mr. McKay replied that when an underground cable had been in use for some time, it is rather hard to tell just what may be happening to it. There might have been a weak spot in the cable to cause the unsteadiness complained of; but it is not likely that the unsteadiness was due to the carbon resistance being in circuit.

Mr. Layman said that in regard to how much self-induction was necessary to keep the lamps nicely balanced, Mr. Spencer had recommended 75 per cent., but he thought a lamp circuit could be burned with excellent results with a power factor of 85 per cent.; Mr. Perkins favored about 81 per cent., but Mr. Layman thought this depends on the construction of a particular lamp. Mr. Perkins referred to the matter of arrangement of circuits, and said he had had occasion to rearrange the Youngstown circuits, using the station as the center of distribution, and running the different circuits out radially like the spokes of a wheel. Circuits should be laid out originally, with an average of 40 lamps, leaving leeway for additions. A better power factor should be sought for on lower loads. Mr. Bechtel believed it was necessary to be careful not to lay out too many circuits so as to avoid increasing the fixed charges for copper investment and for extra transformers. The fixed charge expense will almost offset the expense of rearrangement complained of by Mr. Perkins. Circuits should be so laid out that they can easily be changed. Mr. Doud stated that his company did not now recommend the use of single circuits of 100 lights, but rather to limit to 75 lights.

Mr. Gaskill stated that his company had lately installed for street lighting, series 7.5-ampere alternating-current lamps, using two 50-light tub transformers; although at first some opposition was experienced he doubted if now the people would go back to the former system. Their plant was of the size usual in towns of 5,000 to 7,000 inhabitants, the present installation being 300-kw. He had formerly been using the open-arc system, and though it had originally operated very satisfactorily, of late years the cost of repairs was excessive, and depreciation rapidly increasing. They had contracted with the city some seven and a half years ago for a ten-year term, at $84.50 per lamp. They had been able by the present change in system to offer a lower rate and to secure a renewal of their contract for another ten years, while reducing their operating expense materially. Their present contract called for $78 per lamp, 7.5 amperes, with a guaranteed delivery of 450 watts at the lamp terminals. Under the Ohio law the council cannot make a contract that does not go into full force during their term of office, and, therefore, could not consider a bid from other parties if offered; but by the present company making the offer at a reduced rate before the expiration of the existing contract an arrangement was consummated satisfactory to all parties. The suggestion was offered for others.

Mr. Beckstein, of the Sandusky Gas and Electric Company, has been using the transformer system for past five or six months, and he referred to the great saving in operating expense secured thereby. Mr. Bechtel conformed this observation. After some further discussion along this line, the papers programmed having been completed, the convention voted to take up routine business. The report of the finance committee, Mr. Raber, chairman, showed that the treasury is in good condition. Columbus was named as the next place of meeting. It was considered by some members that the date of October is too late and too far into the busy season, and August was favorably spoken of as a suitable date.

A Buffalo Diploma.

The buildings and grounds committee of the late Pan-American Exposition, at Buffalo, N. Y., has issued recently a very handsome "commemorative diploma" to several of the officials most actively engaged on the work of the exposition, "to whom the award of a gold medal was made by the board of directors of the Exposition Company." Such an honor is well deserved, and is much appreciated by the recipients, but one of the mysteries and deep disgraces of the thing is that neither Mr. Rudolph Ulrich, the landscape artist, Mr. Luther Stieringer, the consulting electrical engineer, nor others, have been included. When one recalls the magnificent and memorable work of those two men, it must arouse indignation everywhere that they should be passed over with such studied neglect. The buildings and grounds committee ought to be heartily ashamed of itself, and the board of directors, too.

The Indiana Mutual Telephone Convention.

The fifth annual meeting of the Indiana Mutual Telephone Association was held in the German Club House, Indianapolis, October 14. The meeting was called to order by G. R. Frazer, of Connersville, president, and will be remembered as the most successful and enjoyable convention ever held by the Association. About 75 members and quite a number of supply men and electrical experts were present. In his annual address, President Frazer said that the attendance of so many interested and earnest telephone men eager for the exchange of experiences in a common undertaking was exceedingly gratifying. Five years ago, when a fragment of their present membership met for the purpose of inducing some reliable company to install a plant in Indianapolis, with a view of knitting their plants together with toll lines, giving an entrance into the State Capital, and for the further purpose of developing the great field, not a few entertained grave doubts—not doubts of the good faith and sincerity of the new telephone company, but doubts of its ability to meet the Central Union in the largest city in the territory. Who among the most sanguine at that time dared to hope for the great success that had attended the efforts of the New Telephone Company?

Mr. Frazer warned the members of the association not to take on a troubled look because some well-meaning farmers on the outer edge of the fields were installing exchanges on their own account. If they can furnish that service better and cheaper they are the ones to do it. They should not care how near their city exchanges the farmers build their lines, but should let it be forcibly understood that they did not build and maintain their city exchanges in a cheap way, and would give connection only on terms that are fair and just.

President Frazer, who is an excellent presiding officer, next took up the subjects presented by the programme, and was successful in bringing out a free discussion by the members present. On the mater of franchises, Hugh Daughtery, of Bluffton; J. W. Weik, of Green Castle, and R. C. Stephenson, of Rochester, discussed the necessity of laws defining the rights of telephone companies and the rights of the people. It was contended by Mr. Stephenson that a telephone line established along a public highway was in no sense an additional servitude; that as a means of communication and as a public carrier, its use of the highway was not only in accordance with the progress of the age, but was primarily contemplated in the purposes of public highways. Other speakers deemed it advisable to ask the next legislature to enact laws providing for franchise rights to be granted by county commissioners, and also providing for condemnation proceedings against private property for telephone purposes. As a result of this discussion, a committee was appointed to draft necessary bills and attend the sessions of the legislature to urge the passage thereof. It was suggested by Mr. C. S. King, of Wabash, formerly a member of the legislature, that this committee be authorized to discourage or thwart any adverse or drastic legislation; that it was a matter of vital importance that no law be passed to compel one company to make a connection with another in the absence of a specific contract. "Such a law is threatened," said he. This revelation appeared to awaken considerable interest among the members and resulted in the adoption of the following resolution:

Whereas: A number of independent telephone companies in the State of Indiana have granted to certain other independent companies connections with their exchanges without first entering into an explicit written contract governing such connections;

And whereas: In many cases such arrangements have led to much confusion and the violation of written contracts heretofore entered into by independent telephone companies, and have occasioned litigation and encouraged attacks upon the doctrine of the right of independent telephone companies to control their business by contract;

Therefore, be it resolved: That the Independent Telephone Association, of Indiana, condemns the practice of granting such connection other than by explicit written contract, in which each company shall have the right to refuse business which shall tend to violate its existing contracts; and be it further

Resolved: That the Association recommends that each independent telephone company in this State shall refuse connection with such companies as have been organized and are operated in cities, towns and communities already supplied with independent telephone service, and which, after such organization, attack the doctrine of the right to control the telephone business by contract.

Hugh Daugherty, of Bluffton, a member of the litigation committee appointed by the National Association, made a lengthy and comprehensive statement regarding the great legal battle that has been going on for the past few years in the shape of defending suits brought by the Bell Company for the alleged unlawful use of patented devices. etc. He said that while they had won every case in the trial courts, several were now pending in the courts of appeal that required the most careful service and the most convincing arguments. Much was due to the manufacturers for their assistance in the defense of litigation brought by the Bell Company. He earnestly insisted that the interests of all present had been protected by the successful defenses made thus far against the Bell Company, and declared it to be vitally important that the fight be continued until the victory is complete. He said such litigation required skilled and learned lawyers, and was in every way expensive, but the outcome meant everything to the independent telephone people. "The litigation committee has expended $37,000 up to the present time, and we have personally obligated ourselves to pay $12,000 more, of which amount we are asking $2,000 from Indiana," said he. Mr. Daugherty said that the Bell Company had spent over $100,000, and had in its employ the best lawyers in the country, some of whom are under contract to give their entire time to the prosecution of these appeals in the higher courts.

The following officers were elected for the ensuing year: President, R. C. Stephenson, Rochester; vice-president, J. W. Weik, Green Castle; secretary-treasurer, Harry B. Gates, Indianapolis. At six o'clock the convention adjourned to the dining room and were entertained by the New Telephone Company and the New Long-Distance Telephone Company of Indianapolis. The convention was a success in every way, was representative in character and conspicuous for its earnestness. The new president, Mr. Stephenson, promised that with the aid and co-operation of the members he would increase the membership and endeavor to have every county in the State represented at the next meeting. He said much of the success of the convention was due to the officials of the New Telephone Company, and after a vote of thanks to that corporation and to the German House Club, the convention adjourned.

Electric Underground Situation in London.

Special cable dispatches from London state that a dramatic development in the fight for the control of London's "tube" railroads occurred on October 21, when it was learned that Speyer Brothers, who are financing Charles T. Yerkes's plans, had bought control of a large company hitherto allied with the Morgans' scheme of transportation, thereby not only reducing the scope of the Morgans' projected line by many miles, but actually threatening it with legal obliteration.

The latest move in this Morgan-Yerkes rivalry was announced at the session of the House of Commons' "Tubes" Committee, by Sir Edward Clarke, who, as counsel for the London United Electric Railways, withdrew the bill providing for the construction of the road, which up to this morning had always been part of the Morgan line, and covered the district westward between Hammersmith and Piccadilly, and southward between Clapham and the city. The Morgans had originally intended to cover these points, but as the London United already had certain powers from the amalgamation effected a year ago and the Morgans' project had passed through Parliament under the title of the London United and Piccadilly and City Railroad, Balfour Browne, who is counsel for the joint bills, expressed surprise in behalf of the Morgan interests at Sir Edward Clarke's announcement, which left him scarcely half the length of the road over which he had been arguing for nearly a year, and requested time to consult his principals.

Amid a sensation the committee adjourned. Mr. Browne then announced that the Morgans were ready to go on with such road as they had left, namely, between Piccadilly and the city, and that they would take the earliest opportunity to introduce a new bill, asking for the powers of which they had so unexpectedly been deprived by the defection of the London United, owing to the Speyers securing control of it.

Counsel representing the Yerkes' interest demanded that the Piccadilly and City Road must also be withdrawn, as it had now no legal status, having been presented to Parliament as part of the London United scheme, which was now non-existent; in other words, declaring that the Morgans now had no legalized tube project at all. The matter was taken under advisement by the committee until October 23.

Underground Work for Telephone Exchanges—VIII.

By Arthur V. Abbott, C. E.

OBSTACLES.

Of all the problems to be solved by the engineer that of surmounting the obstacles presented by various street structures is the most difficult—not only in design of a way to place conduits in unreasonably restricted space, but because it is usually very difficult—sometimes impossible—even with the utmost care and skill to foresee the existence of insurmountable barriers until a large portion of the work has been done and considerable expense incurred. Electrical subways are usually among the last of street structures to be introduced, consequently they must content themselves with what space remains after sewer, gas, water, etc., have each appropriated all of the street they could occupy. If the real condition of the sub-soil of city streets was accurately known, a possible location could usually be selected, but as the office of the city engineer is usually a political position, it may be confidently predicted that any information derived therefrom as to location of street obstacles is inherently incorrect, and the subway designer can be quite sure that pipes and other impedimenta to conduit location are

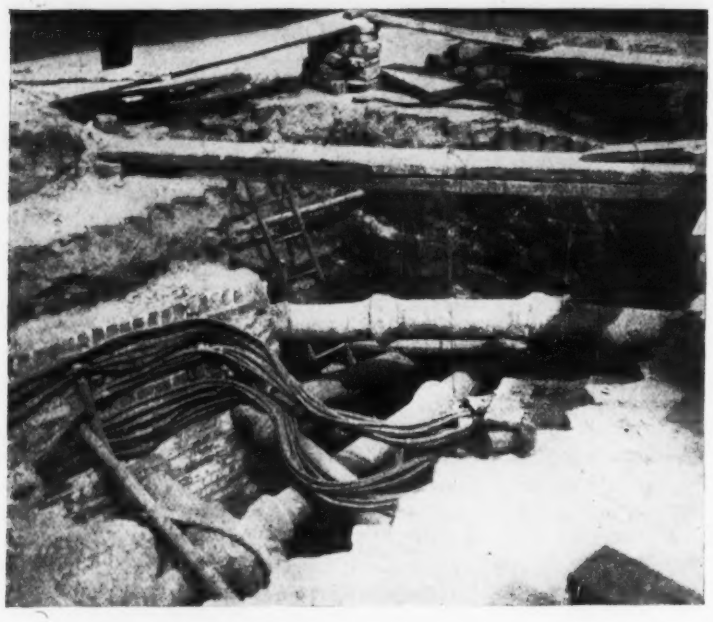


FIG. 47.—HARRISON STREET AND WABASH AVENUE, CHICAGO.

certainly not where the records show them to be. Wherever else they actually are, is quite another matter, and one which the telephone engineer must find out for himself as best he may. This state of affairs is perhaps no surprise when such subterranean complications exist as are depicted in Figs. 47 and 48, showing the corner of Harrison and Washington and Market and Washington streets, Chicago, and in Fig. 49 an excavation in Union Square, New York. Still, as no permit to open a city street can be gained save through its Department of Public Works, nor work therein prosecuted excepting in the presence of a city inspector, whose salary is charged against the corporation making the excavation, it seems strange that accurate records are not kept.

When the construction of a conduit is determined upon, the first step is a careful topographical survey of the proposed location, giving all of the surface features, including street alignment, grades, the location of fire plugs, car tracks, gas and arc lamps, catch basins, drains, etc. This information will at least give a rough idea of what exists below the pavement, though there is an equal assurance of many additional obstacles. An appeal to the City Hall will now supply a fair idea of what is likely to be encountered, but with no very accurate information as to where it is. Consultation with the other corporatons—gas, water, sewer, electric light, telephone and telegraph companies—will yield many illuminating side lights, and wth all the information thus gathered, a careful ground plan, together with probable cross sections at each street corner, should be plotted, showing the expected location of existing structures. Thus armed, the engineer may plot a proposd design for his conduit, and manholes, and will usually find that almost an ideal one can be obtained. Proceeding to the ground, a series of test holes along the entire proposed location should be dug at every street corner, and, if suspicious circumstancs arise, at intermediate points—for a little wasted street trench will pay for many test holes. At each pit, the location of the sub-structures encountered, both vertically and horizontally from the curb, must be noted. This information enables the designer to prepare a set of drawings, as shown in Fig. 50, embracing a general ground plan and all test pit sections. Usually this examination will reveal a gas pipe, catch basin, or something else located just a few inches away from its supposed position, and exactly in line with the desired conduit, which must be moved or a new location sought. But once having settled—from test pit information—the position of obstacles, the designer can proceed with a fair sense of security; though even with such precautions cases have arisen within the experience of the writer, when sub-sfructures so deviated from their rightful course between test pits as to require removal before conduit space could be obtained. Obstacles may some times be surmounted by the use of slight curves, either vertical or horizontal, in the conduit, though this is not a practice to be commended. Usually gas, water and electric light companies are cordial, and willing on the payment of reasonable expense, to make such slight changes in the location of their property as will enable a conduit to be placed, so that by one expedient and another the engineer must thread his way from corner to corner.

VENTILATION.

Few instances in engineering practice illustrate so forcibly the existence of the unexpected as the subway explosions attending the

FIG. 48.—MANHOLE, MARKET AND WASHINGTON STREETS, CHICAGO.

introduction of the first conduits in New York City. Particular pains were taken to make the conduit presumably air tight—constructed of wrought iron pipe, with threaded joints, equipped with double-covered gasketed manholes, it seemed an impossibility that it should be otherwise than hermetically sealed. But a brief period of operation had elapsed before the public was astonished by a series of explosions that took place in the various subway manholes. Investigation showed that owing to the porous character of the cast iron pipes employed by gas companies, a large proportion of their product leaked away in the surrounding soil, completely saturating it. In many cases the illuminating gas was slightly heavier than the atmosphere, and the manholes formed convenient settling places into which, in spite of the precautions taken to secure tightness, the gas gradually accumulated, and from various accidental causes occasionally became ignited, producing disastrous results. Such a state of affairs is a serious public menace, and two methods are now in current practice to avoid danger from this source. These may be described as the *"artificial"* and "natural" ventilation methods. The "artificial" ventilation method may be accomplished in either of two ways. In New York the expedient of laying alongside the cable ducts an additional air pipe, opening into each of the manholes, and terminating at some convenient point in a blowing station, equipped with a powerful fan, has been adopted. The conduit is made as nearly air tight as possible, so that the office of the fan is chiefly that of maintaining a counter-pressure transmitted through the air pipe to all manholes, thus keeping the whole system under a plenum, and preventing the entrance of any gases

whatsoever. That this is the surest and most efficient way is little questioned, but it is too expensive for any but the largest and most important installations—the necessary blower plant for a medium-

FIG. 49.—A NEW YORK STREET CORNER, SHOWING UNDERGROUND PIPE CONSTRUCTION.

sized conduit system costing from $60,000 to $80,000, while the annual maintenance expense amounts to from $15,000 to $20,000. To avoid this installation and operating expense each of the various manholes may be connected with a small standpipe made of 3-inch or 4-inch casing tube (conveniently attached to adjacent buildings), which operate as chimneys to create an air current in the manholes, thus removing noxious gases. While this plan reduces initial expense and obviates maintenance charges, it is burdened with the objection that it constantly operates to produce a slight vacuum in the manholes, and so, while it offers an escape for the gases, it invites their entrance. Both systems of artificial ventilation are illustrated in Fig. 51. The most recent practice in conduit construction indicates that if prior and subsequent to the introduction of the cables the ends of the ducts are carefully packed to impede as much as possible the entrance of gases into the manholes, and if the covers are perforated as thoroughly as adequate strength will permit, sufficient ventilation will naturally take place to prevent the formation of explosive gaseous mixtures. Conduit systems are, therefore, now universally installed by dispensing with special methods to produce ventilation, equipping manholes with open covers in the belief that sufficient precautions against subway explosions are thus secured.

RODDING.

Upon the completion of a conduit, provision is necessary for the introduction of cables. This is usually accomplished by what is known as the process of "Rodding." Workmen are supplied with a number of light jointed rods, either of wood or pipe, of such a length as to be readily handled on the inside of the manholes. It is desirable that the joints should be hook joints instead of screwed joints, so that the rods may not unscrew as they are forced through the duct. Rod after rod is introduced into a duct, the succeeding one being attached to the preceding one by its proper joint. In this manner the rods are gradually pushed from one manhole into the next one. As soon as the first rod arrives in the second manhole, a rope is attached to the end of the rod in the first one, and the workman in the second manhole pulls the rod and its attached rope along, disjointing the successive pieces as fast as they arrive. Then the rope is attached to a fish wire—usually a piece of No. 10, B. W. G., galvanized iron wire, which is pulled into the duct and left in place to serve as the primary means for pulling through the duct the rope to which the cable is subsequently attached. After the fish wire is in place it is desirable to plug each end of each duct with a hard wood plug, in order to prevent the incursion of gas into the manhole, and to avoid the collection of all sorts of debris in the ducts themselves. Where many ducts are to be rodded simultaneously the process of pneumatic rodding may be conveniently employed. By this plan the workman in one manhole is furnished with what is technically called a "mouse." This consists of a small spool-shaped piece of wood carrying a leather washer on each of its ends, that closely fit the bore of the duct. To the rear end of the mouse a light line is attached. In the other manhole the workmen are provided with an air pump carrying a leather cup that enables it to be readily attached to the mouth of the duct. The mouse being placed in the end of a duct a few strokes of the air pump produces a sufficient vacuum to cause the mouse to fly swiftly through the duct, dragging

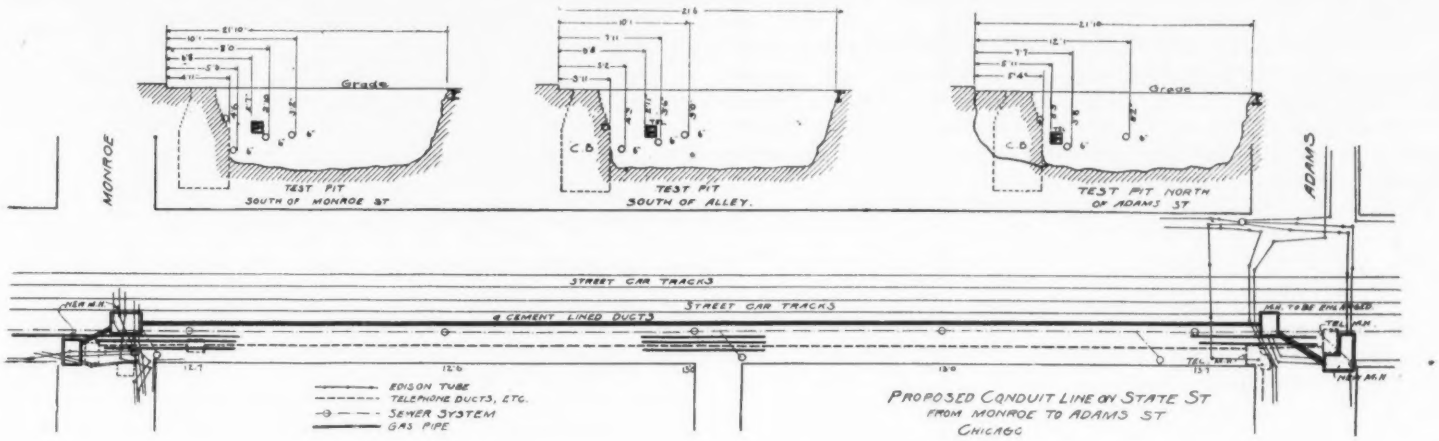


FIG. 50.—TEST PITS.

the cord after it and make its appearance at the end where the air pump is applied. When ducts are reasonably free and clear, and a large number are to be rodded, this process materially reduces the necessary time and expense.

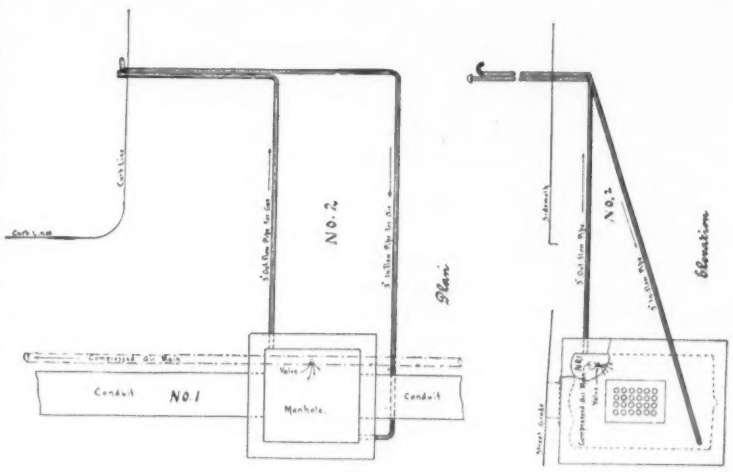


FIG. 51.—VENTILATING SYSTEMS.

Recent Electrochemical Developments.

By Clinton Paul Townsend.

ARTIFICIAL GRAPHITE.

A patent has just been issued to Mr. E. G. Acheson, on a method for the artificial production of graphite, which is the logical outcome and sequence of his prior work. It will aid in understanding the relation and importance of the present method to briefly outline Mr. Acheson's previous work in this line.

His first observation was that coke might be freed from its impurities, and its conductivity largely increased, by the direct passage of a heating current; shortly afterward he discovered that carborundum and other carbides might be directly transformed to graphite by the employment of sufficient heat to volatilize the non-carbon element. Later observations led to the conviction that the conversion of carbon to graphite by any method of resistance heating depended upon the presence in the carbon of definite proportions of such carbide-producing elements as silicon, iron and calcium, and that, therefore the two methods above noted were substantially identical in so far as the chemical reactions were concerned; and that such impurities need not be present in proportion sufficient to react at once with the whole of the carbon, but that the transformation into graphite may be progressive in character, carbides being formed and decomposed, and the volatilized non-carbon element entering into combination with adjacent portions of the carbon. It was also observed that an artificial mixture of carbon with impurities was unnecessary since non-coking coals and certain varieties of charcoal contain mineral ingredients, proper in kind, sufficient in quantity and suitably distributed.

According to the present disclosure, it is found that in the case of volatile impurities the original distribution is unimportant. If, for instance, petroleum coke in the form of lumps and in rough admixture with iron or iron ore be suitably heated in an electric furnace, the vapors of the metal so permeate the enitre mass as to determine its complete transformation into graphite.

CAST ARTICLES OF REFRACTORY COMPOSITION.

Mr. Charles B. Jacobs has discovered a novel method leading to a new and seemingly valuable product. By subjecting acid silicates, such as the compound $Al_2 O_3 2SiO_2$, which forms the base of ordinary fire clay and kaolin, to continued fusion at the high temperature of the electric furnace, a certain proportion of the silica is volatilized as white fumes, leaving a melt which solidifies into a hard, tough mass of waxy appearance, having the chemical composition of the known normal silicates of aluminum, but possessing distinct physical properties, and being therefore a new product.

For effecting the fusion, any usual type of electric furnace may be employed; as an example, it is stated that a current of 100 volts and 1,500 amperes will bring about 200 pounds of the material into fusion in twenty minutes, and that the continuance of the fusion for 40 minutes more suffices to volatilize one-half of the silica, leaving the normal salt. The fused mass is run into metal molds of any desired shape. The uses suggested are for bricks for paving, building and furnace construction, tiling and refractory conduits of various kinds.

PURIFICATION OF SUGAR JUICES.

The latest electrolytic method for the purification of sugar juices emanates from Kiew, Russia, the inventor being Albert Baudry. Chemically considered, the process is substantially that known abroad as Urbain's, with the addition of certain dialytic features, adapted from still earlier art. The cell employed in the first treatment is divided into three compartments, of which the central one contains the juice and anodes. The external compartments containing the cathodes are filled with water, and are separated from the anode compartments by diaphragms of parchment. The anodes are of soluble metals, such as zinc, aluminum and lead. Upon passage of the current the bases of such salts as the juice may contain are transferred to the water around the cathodes. Before this operation the juice has received the usual treatment with sulphurous acid.

After concentration the juice resulting from this preliminary treatment is again electrolyzed in a similarly constructed apparatus, the polarity of the electrodes being now reversed so that the water surrounds the anodes. The acid radicals of the salts are now removed from the juice and the sulphurous acid which is injected during the second treatment is reduced by the hydrogen to hyposulphurous acid, the great decolorizing power of which is exerted under favorable conditions. The syrup may undergo a still further treatment in a third electrolytic vat, wherein both anodes and cathodes are immersed in water, the solution passing through intermediate compartments. This supplemental dialytic treatment seems to be precisely the method proposed many years ago by Despeisses. The claim that the conjoint use of the methods of Despeisses and Urban yields excellent results as regards increase in the coefficient of purity, and particularly the elimination of extractives and colors would seem to be well founded.

New Telephone Patents.

The Patent Office on September 30th issued no less than six patents supposed to pertain to telephony. The qualification "supposed" is used advisedly, for while one of the patents, which the inventor states is applicable to both telegraphy and telephony, may be of some use to the former art, it is not in any way apparent what service it can render in telephony. The device referred to is termed a "Selective Call," the mechanism of which is akin to the ordinary electrically-controlled mechanical gong, except that in order to signal any one of several instruments to the exclusion of the others on the same line, all must be provided with pendulum escapements, which are to be synchronously started by receiving simultaneous and successive taps from an electromagnetic device responding to a manually-operated circuit closing key. The operator must observe his own pendulum to determine when and how many times to close the circuit, on the supposition that all pendulums will reach the normal amplitude of vibration simultaneously.

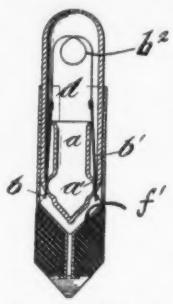


FIG. 1.—SIGNAL LAMP.

Taking up the other patents in the order of their serial numbers, one having for title, "Signal-Lamp for Telephone Switchboards," granted to F. R. McBerty and F. H. Loveridge, and assigned to the Western Electric Company, relates to a cheap method of construction of telephone incandescent lamps. The lamps are adapted to a socket; at one end the terminals of the lamp and socket must register, and at the other end is a translucent lens which must be illumined with maximum efficiency. Fig. 1 shows the invention well, where *a* is a tubular stem with a raised portion, a^1, which is adapted to be sealed to the body of the lamp in a manner to not only support the filament but to form a seal of such small mass that the liability to cracking is reduced. The loop in the filament, b^2, makes the end illumination a large proportion of the whole. The terminal mounting

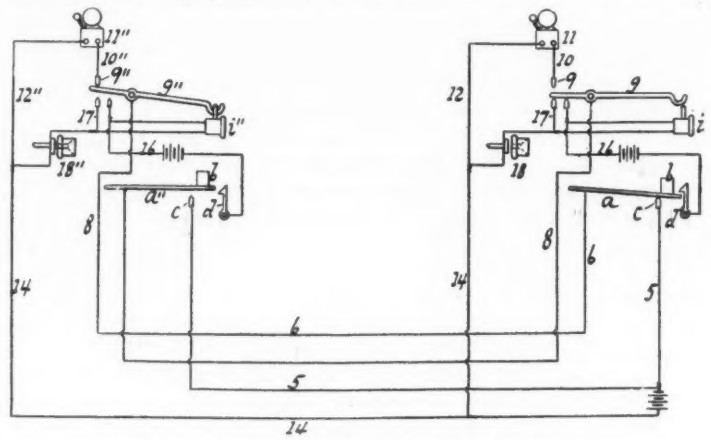


FIG. 2.—LOEFFLER SELF-RESTORING TELEPHONE.

is of quite novel construction, the clamping effect, which is essential with this type of lamp, being obtained through the agency of the small wood block, shown heavily cross-hatched.

Under the title "Self-Restoring Telephone," Mr. L. J. Loeffler has obtained a patent for an intercommunicating system switchboard and circuit. Both may be readily understood by referring to Fig. 2. Only two stations are shown, but the system is suitable for a larger number. One wire from each station, which shall connect to every other station, is necessary, as usual with intercommunicating sys-

tems. At *b* is represented one of a number of push-buttons, arranged in a vertical line, each of which corresponds to one station. Each button bears upon a strip of metal, a^1. Beneath the row of springs is a dog, *d*, whose position is so controlled by the hook switch that when the receiver is off the hook it overlaps the springs, while with the receiver on the hook the dog is swung clear of the springs. Now, suppose the receiver hook is up, then if button *b* is depressed to its fullest extent the spring will slide over and past the dog, and contact will be made between the spring strip and the battery bar, *c*.

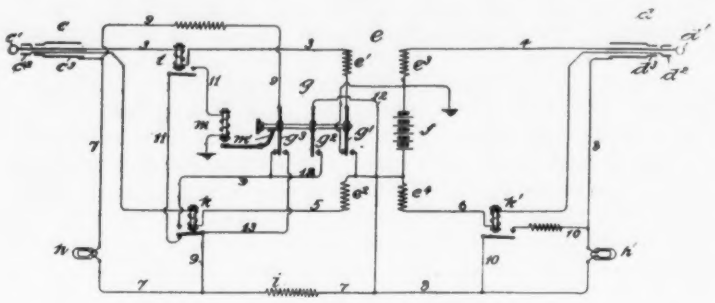


FIG. 3.—DEAN TOLL APPARATUS.

In this position no electrical contact exists between the dog and spring strip. This is the condition of circuit at the right-hand station, which is shown calling the left-hand one. When the button is released, it is caught by the shoulder of the dog, thereby completing the talking circuit. Whenever the receiver is returned to the hook, the latter throws back the pawl, disengaging the spring strip and clearing the line automatically for further use.

Patent No. 710,309, granted to Mathias Weisser, is purely a design patent, showing and claiming one of the many ways of making a transmitter case of thin sheet metal, and the method chosen does not appear to have any particular merit. Both of the remaining patents of the issue are assigned to the Western Electric Company, the one being an invention by William W. Dean, of Chicago, and the other by F. R. McBerty.

Mr. Dean's patent, No. 710,318, describes telephone switchboard circuits, especially adapted to a special toll-charging system, wherein a manually-operated counting device is located at the instrument of the subscriber, so electrically controlled at the central office that on the completion of a connection, conversation is refused until the registering of the call automatically restores the circuits to their normal condition. The way in which this result is accomplished can be best followed out by referring to Fig. 3, which shows a modified cord circuit of the Bell Company's common battery system. The subscriber's lines are provided with the usual lamp, as well as line and cut-off relays at the subscriber's station; in addition to the usual apparatus there is included two push-buttons, one of which is connected to the mechanism of the message counter as well as to the electrical circuit, and which will hereinafter be referred to as "key *a*"; the other button concerns the electrical circuit only, and will be

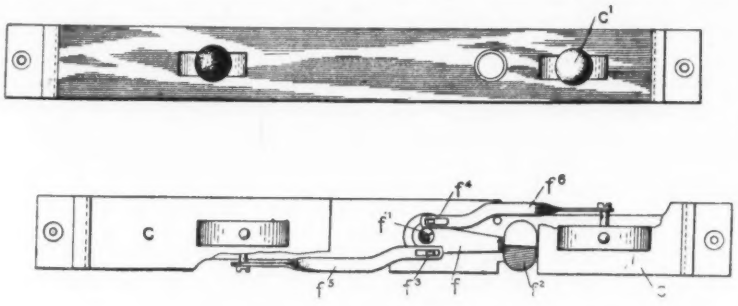


FIG. 4.—M'BERTY SELECTIVE CALLING APPLIANCE.

known as "key *b*." On the central office operator receiving a call according to the accustomed manner, before completing the connection she presses the controlling key (shown diagrammatically, all other keys being omitted from the drawing for convenience), which immediately locks in the depressed position. This operation results in the normal ground connection being removed from the middle terminal of the repeating coil, e^1, battery connection being established in its stead. Thus the same pole of the battery is connected to both sides of the subscriber's line, and relays *k* and *l* are both de-energized. The supervisory lamp, which is normally controlled by the subscriber's hook switch through the agency of the relay *k*, does not, however, light, as a contact of the control key in its depressed position supplements that of the relay.

The operator now proceeds to complete the connection. At this stage, the calling subscriber can hear all that goes on, through his repeating coil whose circuit is still effective for this purpose. He cannot, however, transmit, for no current is flowing through his transmitter, both sides of the line being at the same potential. When he hears the response of the called party has answered in order to hold conversation with him the subscriber originating the connection has only to push his key, *a*, which registers a call, and at the same time energizes relay *l*, releasing the control key and re-establishing normal talking conditions. In case through some failure the connection is never completed, the calling party may signal the operator to restore his service by depressing key *b*, this acting so to ground the line that relay *k* operates, acting through the lower contacts of the control key to neutralize the effect of the shunt on the supervisory lamp.

Mr. McBerty's invention is a useful contrivance for ringing keys, used in connection with selective signal two-party lines, and consists of an indicator to show the operator which party was last called. This device is very simple, and is so well shown in Fig. 4 as to need no further explanation. The indicator becomes of particular service at those times when through failure to respond, it becomes necessary to ring the desired party a second time, as on the one hand it relieves the operator of trusting to memory as to which party was desired, with the consequent errors; and on the other hand it relieves the subscriber of the annoyance of being asked repeatedly as to which was desired.

The Patent Office issue of October 14 includes two patents relating to telephony. One of these, having the title "Telephone Transmitter," has reference only to the application of the telephone to the use of the deaf. The invention consists in the hinging together of two or more telephone transmitters, which are to be connected in the same electric circuit and forming a portion of a telephone set designed to enable the deaf to hear what transpires in their immediate neighborhood. By the aid of the several transmitters hinged together, the user may conveniently point the mouthpieces at different angles, and thereby collect sounds approaching from several directions. The patent for this device is granted to Mr. M. R. Hutchinson, and assigned to the Akouphone Manufacturing Company, of New York.

The second patent relates to a printing telegraph and its application to telephone systems. By means of this instrument it is proposed to enable one telephone subscriber to leave a message for a second one should he for any reason be not available for conversation. Mr. William F. Smith, of San Francisco, is the patentee, and the invention so far as described is only applicable to magneto-telephone systems with local battery transmission. The circuits are so arranged that when the central office operator has in the usual way connected a desired line to the one from which a call for it originated, if the called subscriber fails to answer, the calling subscriber may print out a message upon a strip of paper, provided at the called station, for that subscriber's future information.

As usual with printing telegraph apparatus, the record is made upon a strip of paper which is brought into contact with the proper portion of a type wheel. This type wheel is revolvable upon its shaft, step by step, each step corresponding to one of the characters. The power to revolve the type wheel and to lock it after each step is supplied through falls and ratchets associated with electromagnets, which are connected to the subscriber's line irrespective of the telephone hook switch, the circuit being so arranged as to be telephonically balanced.

The sending mechanism, which is adapted to make and break the connections between the battery and the electromagnets a definite number of times, corresponding eactly with the location of the desired character upon the type wheel, is operated by the subscriber through the agency of a slide button. This slide button runs over a scale, giving all characters which it is possible to send, and when placed opposite any one of these and released, the automatic return of the button to the normal position performs all necessary operations at the receiving station. These operations embrace the rotating of the type wheel, making the impression, advancing the paper and resetting the apparatus.

As an accessory to a telephone system with its stations scattered over a considerable territory, this apparatus does not appeal strongly

to one, because all past experience has shown that simplicity of apparatus at the subscribers' stations is one of the first essentials to a successful telephone installation. Considering this fact, the necessary accuracy of the motion of the various parts of the receiving and transmitting mechanisms and the compàratively complicated nature of them seem prohibitive to a general application of the invention where any failure to record would probably be a source of such annoyance to the subscriber as to far outweigh the advantages gained from its installation.

Ionization of Gases.

At a meeting of the Franklin Institute, September 25, Dr. Geo. F. Stradling read a paper on the subject of "The Ionization of Gases," an abstract of which is given below.

It has been shown that by the passage of the electric spark through steam as well as by the passage of current through alkali salt vapors, products appear which conform in quantity to Faraday's laws of electrolysis. By a variety of processes a negative ion, which is not the same in mass as the negatively charged ion of liquid electrolysis, can be separated from the atom. The remainder having a positive charge differs according to its origin, while all negative ions seem to be alike in rarefied gases. The chief agencies in the production of ions are: (a) Rays from radioactive substances—Becquerel rays. (b) Röntgen rays. (c) Ultra-violet light. (d) Kathode rays. (e) Certain chemical processes. (f) High temperature. (g) Electrostatic stress. (h) Impact of moving ions. (i) Spontaneous production.

These are not all independent. Both positive and negative ions, when the ratio of electric force to gas pressure is sufficiently low, become attached to groups of molecules. Generally the negative ions move more rapidly than the positive ones. However, in the case of ions produced by high temperatures it seems that higher speed goes with the positive ion.

Among the things explicable by the theory of ions are: Many of the phenomena of the discharge of electricity through gases; the tending of the electric current through a gas toward a maximum as the e. m. f. rises; the discharge of hot conductors at a lower potential when charged negatively than when positively charged; possibly the weight changes accompanying chemical action observed by Sanford, Landolt and Heydweiller; the occurrence of auroræ; the luminescence of nubulæ.

Atmospheric air contains ions. By their presence is explained the discharge of electrified bodies which takes place independent of the leakage across the insulators. While the rate of dissipation of the charge is greater for both positive and negative electricity on mountains than on the lowlands, it is far greater for negative, because the negative charge of the earth having a very high density upon the peaks attracts thither great quantities of positive ions. The dissipation is much more rapid on clear than on dull, foggy days.

If a charged body be surrounded by a cage of wire similarly charged, the latter attracts ions, some of which pass within it and thus accelerate the discharge of the body inside. If the cage and body are oppositely charged, the discharge is made slower.

Ebert insulated a portion of the earth, let its charge be dissipated by the rain of ions constantly occurring, and again connected it to the earth. Then a current flowed from the insulated part to the earth. It took in some cases only five minutes for the discharge by ions to be completed. This undoubtedly shows a very high rapidity of discharge for the earth.

The origin of the atmospheric ions is to be sought in the action of ultra-violet light in the upper regions of the atmosphere and in kathode rays developed there by negatively charged particles arriving from the sun.

Commercial Cable and Postal's New President.

The directors of the Commercial Cable Company on October 15 elected Clarence H. Mackay president and George G. Ward chairman of the board and of the executive committee. Mr. Ward will continue to be vice-president and general manager. Mr. Mackay was also elected president of the Postal Telegraph Company and of the Pacific Postal Telegraph Company. He succeeds his father, the late John W. Mackay, in all these posts.

Chairman Ward contradicted a published report that the Commercial Company's Pacific cable would go no further than Honolulu. The contract for the entire cable to Manila has been let, he said, and the line to Honolulu will be working by January 1. The line to Manila, it is expected, will be ready for operation by July. The company has made no contract to lay a cable from Honolulu to Fanning Island, a recent despatch from Honolulu to the contrary notwithstanding.

Wireless Telegraphy on a Moving Train.

During the passage of the special train on the Grand Trunk Railway, between Toronto and Montreal, on October 13th, bearing the members of the American Association of General Managers and ticket agents from Chicago to Portland, wireless telegraphic signals were received by the party as the train passed St. Dominique station, at the rate of 60 miles an hour. No special attempt was made to signal to a great distance, but the train remained in touch with the station for from 8 to 10 miles. Two vibrators, 10 x 12 feet, connected with an induction coil of the usual pattern (8-inch spark), served to transmit the waves from the station, while on the train itself the waves were received by a coherer of the ordinary type. A relay rendered the signals audible to the passengers by ringing bells in three cars. The collecting wires were run through the guides for the signal cord inside the train, and extended about one car length on either side of the coherer. Owing to the natural vibration of the train it was impossible to have the relay at the most sensitive point, but the distance to which it was possible to keep the train in touch with the station was considered very satisfactory by the various officials. The apparatus was loaned for the experiments by the Physical Department of McGill University, Prof. E. Rutherford and Prof. H. T. Barnes, assisted by Mr. H. L. Cooke, being present to look after the adjustments. Dean Bovey and Prof. C. H. McLeod, of the Engineering Department of McGill, also witnessed the experiments.

CURRENT NEWS AND NOTES.

MASTER ELECTRICAL MECHANIC FOR NAVY YARD.—An examination will be held October 29, at the New York Navy Yard Brooklyn, to fill a position of master electrical mechanic. The rate of pay is $6.00 per day.

A CORRECTION.—In the article by Mr. Virginius D. Moody, printed in our issue of October 18, a typographical error appears in the formula for computing the full-load current. As given, the equation reads, $I = \frac{Kw \times 2}{E \times \sqrt{3}}$. This is to be corrected by removing the numeral 2 from the numerator.

A COAL BATTERY.—Hugo Jone, a chemist for the city of Chicago, who has figured in the newspaper press as an investigator of the problems of obtaining electrical energy from coal, is reported to have one of his cells now undergoing tests by City Electrician E. B. Ellicott. No details of this new cell are given out by Mr. Jone, except that it is a gas cell. Mr. Jone claims to have tested the cell enough to be satisfied that the efficiency of the process is considerably ahead of the usual method of generating electricity by steam power. About a year ago Mr. Jone gave a newspaper account of a battery of his, but the present battery is stated to be a decided improvement over the one upon which he was then working.

CORRESPONDENCE SCHOOLS.—"The Place of Correspondence Schools in Electrical Education" was the subject taken up at the Chicago Electrical Association the evening of October 17. Harris C. Trow, of the American Correspondence School, read a paper on hat subject, and a lively discussion followed. Some points were brought out of considerable interest, as showing the results of correspondence instruction. It seemed to be the general sentiment of the meeting that the best of correspondence schools are doing good work, and that the pupils taking the full courses undertaken were well rewarded. The fact was brought out that the expenses to the schools of carrying pupils through the full courses is more than the tuition, and but for the profits on those dropping out, the tuition would have to be much higher. The pupils who stay by are the ones that get their money's worth.

JOHN FRITZ DINNER.—The requests for tickets for the John Fritz Medal Banquet, at the Waldorf-Astoria ballroom, on October 31, have become very numerous, and had already reached about 400 early this week. The indications point to an attendance of not less than 500. All the presidents of the four national engineering societies will be present, and the deep interest manifested in each branch attests the popularity of the idea of founding this gold medal, the first of the kind in the United States, due to the co-operation of men engaged in different fields of professional engineering. Tickets for the dinner, including wines and cigars, cost $12; and for ladies in the ballroom boxes, including light refreshments, cost $3. The Dinner Committee will be greatly assisted if orders, with check, are sent at once to Mr. John C. Kafer, The Engineers' Club, 374 Fifth Avenue, New York City.

MUNICIPAL ELECTRICIANS.—Following is a list of the officers of the International Association of Municipal Electricians, elected at the recent meeting in Richmond, Va.: President, W. H. Thompson, Richmond, Va.; vice-president, Jere Murphy, Cleveland, Ohio; second vice-president, A. C. Farrand, Atlantic City, N. J.; third vice-president, W. A. Barnes, Bridgeport, Conn.; fourth vice-president, C. L. Williams, Meridian, Miss.; secretary, F. P. Foster, Corning, N. Y.; treasurer, Adam Bosch, Newark, N. J.; executive committee: Walter M. Petty, Rutherford, N. J.; Elmer G. Loomis, Allegheny City, Pa.; William Brophy, Boston, Mass.; Austin S. Hatch, Detroit, Mich.; J. B. Yoekel, Baltimore, Md.; W. Y. Ellett, Elmira, N. Y.; F. C. Mason, New York; G. F. McDonald, Ottawa, Canada; William Crane, Erie, Pa. Next year's convention will be held at Atlantic City, N. J., the date to be announced later.

THE PRESIDENT'S TROLLEY ACCIDENT.—The finding in the inquest following the accident in which President Roosevelt's body-guard, William Craig, was killed here early in September, filed on October 15, says that the "unlawful acts of James T. Kelly, conductor, and Euclid Madden, motorman," of the electric car which ran into the President's carriage, "contributed" to the death of Mr. Craig. The finding was by Special Justice Hibbard, who states that the horses attached to the President's carriage were going at the rate of six miles an hour, and the car at from 15 to 25 miles an hour. He also finds that there was a misunderstanding on the part of the street-car companies of the city as to what thoroughfares were to be closed to traffic during the President's visit. No evidence, the report says, was found to show that the car was not running at regular schedule, or that the officials of the road had given any orders for it to be run otherwise than under normal conditions.

A. I. E. E. LOCAL AT PITTSBURG.—The committee of the Institute on local organization had a meeting under its auspices at Pittsburg, on October 13, where there gathered together over 125 young men, mostly college graduates, at the call of the chairman of the committee on local organization. The meeting was called to order by the chairman, who made a few remarks about the scope of the work of the American Institute of Electrical Engineers, the advantages of membership in it, followed by an address by the president, Mr. Scott, reading of the paper prepared by Mr. Lamme, and discussion of it by Messrs. Lincoln, Scott, Storer and others. After the meeting, a large number of application blanks for membership in the Institute were given away, and demands for more were registered. The meeting was a great success, and a temporary committee was elected to meet and prepare a scheme for organization and to call the next meeting, announce speakers, etc.

TELEPHONY IN NEW YORK.—The new International Telephone Company, with a mortgage of $100,000,000, proposes to give New York City a taste of independent telephony. The officers are: President, S. B. Rinehart, of Waynesborough, Pa., president of the Frick Company and Citizens' National Bank of Waynesborough; vice-president, Charles W. Mackay, of New York; treasurer, William B. Ehlen, of Baltimore, Md. Secretary Fay states that the company was originally organized to manufacture the patents of Ellis F. Frost, of Washington, and it was later decided to enter the telephone field, using the devices invented by Mr. Frost. These include a combined transmitter and receiver, and a circuit system that are said to cost one-half the price charged for the ordinary desk telephones, and a cable and battery system, for which the claim is made that the cost of construction and maintenance will be one-half that of the cheapest telephone system in use to-day. Mr. Fay said that the company has no fear that it will make money on the lines they intend to establish and operate at the low rate to be charged. So far as known, the company has not an inch of underground conduit or cable with which to start operations.

BELATED TRANSFORMER PATENT.—In our issue of May 3, notice was made of a fundamental transformer patent, granted April 22, to Elihu Thomson, on an application filed November 2, 1885. Owing to the interest in this patent, we reprint below from the current issue of the *American Electric and Automobile Patents Monthly* a list of the references cited in examination of the application: Interference with application of K. Zipernowsky and M. Deri, Buda-Pest, Hungary and Vienna, Austria; C. F. Brush, Cleveland, Ohio; W. E. Sawyer, Washington, D. C.; W. K. Freeman, Astoria, N. Y.; A. Bernstein, Boston, Mass.; R. M. Hunter, Philadelphia, Pa.; patent to Gaulard and J. D. Gibbs, Middlesex County, England, 351,589, October 26, 1886; E. Thomson and E. T. Houston, Lynn, Mass.; R. N. Dyer, Menlo Park, N. J.; T. A. Edison, Llewellyn Park, N. J.; Westinghouse Electric Company, Pittsburg, Pa., Decision favorable to Thomson.—*Telegraphic Journal*, April 1, 1879, p. 117. Brush, 219,209, September 2, 1879. Edison, 265,786, October 10, 1882; 278,418, May 29, 1883; 287,516, October 30, 1883. See R. Kennedy's article in London *Electrical Review*. Zipernowsky and Deri, 3,379, 1885, England; 33,951, 1885, Germany. *Elektrotechnischer Zeitung*, 1885, pp. 290, 286-390.

BREMER ARC LAMP.—A patent, issued October 14 to Hugo Bremer, Neheim, Germany, relates to the manufacture of composite electrodes of arc lamps, the claims covering a self-flushing electrode containing an intimate mixture of carbon and an akaline earth fluoride in excess of 10 per cent., with or without from one to three per cent. of a compound of boron, potassium or sodium. From 20 to 50 per cent. of calcium or magnesia fluoride is mixed with calcined carbon, and to avoid any tendency to flicker of an arc, there is added from one to three per cent. of borax, boric acid, or potassium or sodium carbonate or silicate. The high chemical affinity between the fluoride and the calcium causes the calcium fluoride for the most part to remain undecomposed even in the temperature of the arc. Such vapors of the fluoride as may form and condense at the slightly colder edges of the carbon again become liquid and fall in drops, carrying with them any small particles of solid slag which may have been deposited by the metallic oxide. In this way the calcium fluoride acts not only as a means for increasing the light yielded by the arc, but also as a flux for the alkaline earths, so that a much larger percentage of such material as fluoride of calcium may be used, or of various other of the alkaline-earth compounds—such, for instance, as calcium carbonate. Moreover, the presence of the fluorine results in a warm, soft, yellowish-red light, approximating the color of sunlight. Thus an arc is obtained of high light efficiency, of agreeable color and very constant in its operation, and electrodes which keep themselves free from accumulating slag. Fluorides of certain other metals or alkaline earths may be employed, provided they are selected with a view to producing the required fluid slag and flux.

LETTER TO THE EDITORS.

High-Potential Effects.

To the Editors of Electrical World and Engineer:

Sirs.—In the ELECTRICAL WORLD AND ENGINEER of August 23, 1902, under the title, "Geissler Tube and Condenser Effects," I described the effect on a rotating disc having a small piece of mica with tinfoil glued to each of its opposite faces, when one piece of tinfoil was connected first to the one side of a spark-gap under a disc, and then to the other side. The piece of tinfoil on the side opposite to that which was attached to an electrode was earthed.

What follows gives the results obtained when the secondary of a small high-potential coil was attached to the electrodes under a rotating disc, an end to each electrode. The condenser of the high-potential arrangement consists of two Leyden jars. The sparks are made between small steel balls. There is nothing unusual about the construction of the high-potential coil, it consisting of the ordinary primary and secondary. Two Leyden jars are used to increase the capacity.

I found that the disc, when connected up as above described, rotated from perfect rest always in one direction; but if started in

the opposite direction, the velocity increased and it continued to rotate that way. When rotating, say, from left to right from rest, and then allowed to come to perfect rest by cutting off the current in the primary of the induction coil or by using a blower as formerly described, upon reversing the current in the primary of the coil, the disc would start and rotate from right to left. The rotations were all rapid, which is partly owing to having increased the current in the primary of the induction coil in order to keep up the snapping spark between the two balls in the primary of the high-potential coil. The disc used was a very fine one and gave with the induction coil alone rapid rotations.

It was clearly shown that there is a main discharge from each side of the secondary of the high-potential coil, similar to the discharge from the secondary of an induction coil, but of higher potential; and that either the reversals as they appear in Geissler tubes when connected in the secondary of the high-potential coil are superinduced on the main discharges, or there is an infinitesimal period of time between a main and a reversal discharge.

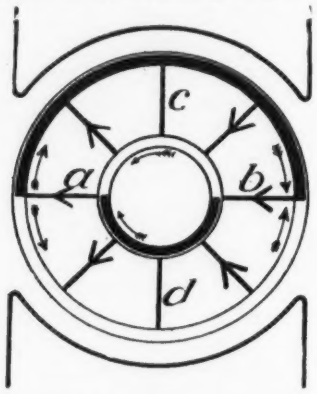
The induced reversals in the Leyden jar of an influence machine occur at exit of the charges, a reversal on each side for each discharge. That it takes place at the exit of the charges leads to the belief that they occur after the main discharges, their images, as it were, appearing in the secondary discharges of the high-potential coil.

BALTIMORE, MD. ALFRED G. DELL.

DIGEST
OF
CURRENT ELECTRICAL LITERATURE.

DYNAMOS, MOTORS AND TRANSFORMERS.

A New Method for Starting Induction Motors.—SCHWARTZ.—An illustrated article in which he first discusses the methods which have been used to start single-phase motors. In the first, the single-phase motor is provided with an artificial winding, which is displaced in space by 90 degrees against the main normal winding, and this winding is supplied with a current displaced in phase against the main current. The disadvantage of this arrangement is the very large starting current. A second method consisted in combining the principle of the alternating-current commutator motor with that of the induction motor, the motor being started as a commutator motor; mechanical and electrical complications are the disadvantages. A third method is to start the motor unloaded and to load it when it has run up to full speed. In principle the author's new method belongs to this third class. To explain its principle he assumes a bipolar non-synchronous single-phase motor, with short-circuited armature. If the armature is at rest and the stator current is switched on, a strong current is induced in the squirrel-cage armature. This is indicated in the adjoining diagram, in which, for the



STARTING INDUCTION MOTORS.

sake of illustration, the external circle represents the front short-circuiting ring and the internal circle represents the rear one. For the sake of clearness the stator is represented by two poles. When the rotor is at rest, all lines of force pulsate in straight lines connecting the two poles. The winding, *ab*, is cut by all lines of force, so that the maximum e. m. f. is induced in it, while no e. m. f. is induced in *cd*. The currents in the bars on the armature (represented by the radii) flow in the indicated directions. Those parts of the short-circuiting rings in which the current flows in a clock-wise direction, is indicated as dark black, while in the other parts of the short-circuiting rings the currents have the opposite direction. The rings, therefore, have a tendency to move, but cannot do so, as long as there is equilibrium. Experiments have shown that a very small lateral direction of the armature in the one or the other direction is sufficient to break the unstable equilibrium and to start a rotation of the rotor. As soon as the position of the rotor is somewhat unsymmetrical, the one short-circuiting ring will be outside of the field and the other ring can follow the impulse which acts on it. Moreover, the rotor and stator currents tend to repel one another, like the primary and secondary of a transformer, but they cannot follow this force as long as the position is unsymmetrical. In order to really start the motor, it is necessary to lengthen the axle of the rotor and to arrange so that the rotor can easily move in the axial direction. The first part of the process consists in pushing the rotor out of its normal position in the axial direction, when the stator field is supplied with current. When the rotor is pushed out it is sufficient to move the rotor by one-half or three-quarters of a revolution by hand or by mechanical means, and the rotor then comes up to speed. When it reaches synchronism, the rotor is drawn back automatically into its former normal position. The fact that the rotor runs up when out of its position, is explained as follow: It is known that single-phase motors without auxiliary winding run up in speed when they are given a small push, provided the phase difference between e. m. f. and current in the rotor has a certain critical value; Arno states that the phase difference of 68 degrees is the best, and he accomplishes this by inserting a resistance in the rotor; in the present case the displacement of the rotor out of the field causes a diminution of the self-induction, which has the same effect. In this way the rotor runs up to synchronism when not in its normal position in the field; when synchronism is nearly reached, the rotor current is very small, and the magnetic attraction acting upon the iron core now prevails and the rotor is drawn into its normal position in the field; at this moment the coupling of the rotor to its load is automatically accomplished by a special mechanical device which is described in detail and illustrated; this device makes it impossible that the coupling can take place at an earlier moment. The first small motion of the rotor when it is out of its normal position may be produced by hand, or in the ordinary way by adding to the rotor an auxiliary phase which may be very small in this case, much smaller than in the ordinary single-phase motors. Furthermore, it is possible to place a piece of iron on the armature axle, which has an important ffect on the starting. By this arrangement a good starting torque is obtained with a considerable decrease of the starting current, so that it is possible to provide larger motors also with a short-circuited armature. If this piece of iron is provided with a winding, there is, so to speak, an auxiliary armature which may be used to further increase the starting torque. By suitably choosing the resistance of this winding, it is possible to make the maximum starting torque take place at the first moment when the rotor is started. After the motor has run up to normal speed, this auxiliary winding is superfluous and is disconnected, which is done automatically when the rotor is drawn into the field in the axial direction.—*Elek. Zeit.*, September 4.

Heyland Motor.—An account of the discussion which followed the reading of the paper of Heyland at the annual meeting of the German Association of Electrical Engineers. The paper itself has already been abstracted in the Digest. Georges referred to his old motor, built in 1891; he did not follow up the matter on account of the greater complications of this type of motor, compared with the ordinary induction motor; the Heyland motor represents a combination of the Georges motor and the induction motor; to understand its action, it is easiest to assume two separate windings, one being connected to the commutator and the other being a short-circuit winding. He says the Heyland motor might be called a shunt motor, in which the winding connected to the commutator is sup-

plied with an essentially constant voltage; he suggests also investigating an analogous series motor. Heyland replied that his motor is of an essentially different type from the Georges motor; a part of the observations made with the latter are also valid for the former, but in entirely different proportions; his motor is essentially an induction motor. Eichberg said that he had repeated the experiments of Georges and found that there were no sparks whatever when the speed was one-third of synchronism; he thinks that the Heyland arrangement has the disadvantage that a small value of the resistance connected in shunt with the commutator segments is unsatisfactory for starting, while with a high resistance the behavior at full speed is worse; he says that the characteristic feature of the Heyland motor lies in the fact that the excitation is made from the rotor, and, therefore, with an essentially smaller frequency; from this results a smaller number of voltamperes. Heyland says he thinks it is possible to build ordinary commutator motors for three-phase currents, and, perhaps, also for single-phase current, which do not spark; it will only be necessary to choose the number of segments so large that the reactance voltage of the coil between the segments is below a certain limit; it is different with the Heyland motor, as the so-called reactance voltage may have any value, and the number of segments is influenced only by the ohmic loss of voltage in the winding and can be made very small. Arnold referred to experiments with a 5-hp single-phase commutator motor, as built by the Wagner Company; he applied the Heyland compensation to it by inserting resistances between the commutator segments instead of short-circuiting them; the power factor could thus be brought to nearly unity; but the current which had to be supplied to the rotor was relatively large; by changing that current the speed can be regulated; at no-load the speed changes between 1,400 and 1,700 when the rotor current is changed from 0 to 115 amperes; the synchronous speed was 1,500, so that considerable over synchronism was obtained; this was the greater, the greater the resistance between the segments. It is peculiar that with a loaded motor the speed decreases with increasing rotor current. He does not think that the Heyland 'evice is suitable for small motors, but that it is of value for large motors, and that the compensation and compounding of the generators has a great future. In reply to a question, Heyland said that his generators, when operated in parallel, run non-synchronously, just like ordinary induction motors; they generate their magnetizing current themselves; if the speed of all machines is held constant, the frequency of the generated current decreases with the load and the slip. If the non-synchronism of the different machines differs, *i. e.*, if the speed of the one or the other machines varies, the frequency attains an average value, in the quicker machines the field lags more and the machine is automatically loaded to a greater degree. It is impossible for machines working in parallel to fall out of step; sparking is also excluded. Ziehl made some remarks on the speed regulation of these machines; with a four-pole motor at 1,500 revolutions, he has found that without the shifting of the brushes it could be brought up to 2,500 to 3,000 revolutions. The speed variation due to shifting of the brushes is very peculiar; if the position of the brushes is changed, the speed varies according to a distinct law. When all three brushes have been shifted around by a full revolution, there is a periodic change of the number of revolutions, the number being sometimes positive and sometimes negative; when changing from positive to negative, the machine is entirely at rest.—*Elek. Zeit.*, August 21.

Bearings.—Dettmar.—An illustrated description of an apparatus for testing bearing oils and bearing metals. He tested several kinds of oil and has found that there is no relation whatever between the quality of the oil and its price. Among six sorts which are suitable, he found the cheapest one to be the best, while the most expensive one was the next one in quality. The Lahmeyer Company has changed the kind of oil which they use, which represents a saving of $500 per year.—*Elek. Zeit.*, August 21.

REFERENCE.

Induction Motor.—Bodensteiner.—An article giving in diagrams the results of tests of the losses in a 170-hp 500-volt, slow-speed, three-phase induction motor.—*Elek. Zeit.*, August 21.

Lights and Lighting.

Lighting.—Lummer.—A very long, illustrated lecture held at a conversazione of the Berlin Electrical Society, on "The Aims of Lighting Engineering." After a historical introduction, he discusses the measurements of light: the Bunsen and the Lummer-Brodhun photometers, the Hefner unit of light, and gives in a table the following series of the photometric economy of the usual sources of light, the figures representing the price in cents per Hefner candle-hour, based on the average prices in Berlin: Incandescent gas light, 0.65; Bremer arc light, 0.5 to 0.75; arc light without globe, 1.25; acetylene incandescent light, 1.5; kerosene, 1.75; arc light with globe, 1.75; Nernst lamp, 2.5; ordinary electric incandescent lamps, 3.5 to 5.0; acetylene, 3.75; argand burner gas light, 3.25; bat-wing burner gas light, 5.25. He then discusses the nature of the different sources of light: luminescence and lighting due to heating. He then deals with the physical principles of light and heat radiation, proves the existence of invisible heat rays and discusses the separation of heat and light rays by absorption of the heat rays in water, etc. He distinguishes between red heat and gray heat (just before red heat) and analyses the physiological phenomena. He discusses Kirchhoff's law of absorption and emission of light, and speaks at length on the absolutely black body and its realization in practice; he discusses the distribution of the energy in the spectrum of the black body, the laws of radiation of bright platinum, the laws referring to the energy maximum and the formula for the distribution of energy. He shows how these formulas can be used to determine the temperature of a black body from its radiation. With the use of such theories the temperature of lights can be determined, or at least given within limits: arc lamp between 4,200 and 3,750° C., Nernst lamp 2,450 to 2,200, Welsbach light 2,450 to 2,200, ordinary incandescent electric light 2,100 to 1,875, candle 1,960 to 1,750, argand lamp 1,900 to 1,700. The temperature of the sun and of fixed stars has also been determined, that of the sun is about 6,000 degrees. Some of the fixed stars have a temperature higher than that of the sun by several thousand degrees. He remarks that the present art in lighting is still far from the ultimate in the production of light without heat. He then discusses the dependency of the illumination upon the temperature. The total radiation is proportional to the fourth power of the absolute temperature, the product of the absolute temperature and of the wave length at which the energy has a maximum, is constant; the maximum energy is proportional to the fifth power of the temperature, while the energy physiologically felt as light increases still more quickly with the temperature. In the yellow part of the spectrum the illumination is doubled if the temperature of the black body is increased from 1,800 to 1,875 degrees, *i. e.*, by about 4 per cent. Concerning the total illumination, he states that if the temperature is increased from 2,000 to 4,000° C., *i. e.*, in the ratio 1 to 2, the illumination is increased in the ratio 1 to 4,000; the carbon in arc lamps has a temperature of 4,000 degrees, the filament of an incandescent lamp 2,000 degrees, hence the arc lamp emits per unit of surface about 4,000 times more light than the incandescent lamp. The sun which glows at 6,000 degrees, emits 600,000 times the illumination per unit of surface of the incandescent lamp. The aim of the light engineers should be to find substances which can be heated up to 6,000 degrees without being destroyed, as at this temperature the energy maximum is within the visible spectrum at the part where our eye is most sensitive. Three overhead incandescent lamps, each of 300 hours' life, are more economical than one normally burning lamp of 1,000 hours' life. In practice, a similar thing is often done, by using 105 or 100-volt lamps in 110-volt installation. This use should be made a principle. The larger sale of lamps of limited life would tend to reduce the selling price. The advantages of the Nernst lamp are due to its elevated temperature. Concerning the temperature of the osmium lamp, nothing definite is yet known. The highest temperature on the earth is in the arc lamp. The introduction of suitable salts in the electric arc is a distinct progression, because more favorable substances are used for producing the light. The vapors of the lithium and strontium salts heated in the arc to enormous temperature do not emit a continuous spectrum, but mainly colored light. These arc lamps become similar to the Geissler tubes, in which the gas in the dilute state is excited to light emission by electro-luminescence. These newest arc lamps represent a connecting link between the light due to heat and that due to the luminescence of colored vapors. The mercury vapor lamp seems to be a pure luminescence lamp. If this is so, the light would be entirely due to free vibrations of electrons, while in the ordinary sources of light there are forced oscillations of the electrons, caused by the molecular movement, due to heat. The paper contains a very large amount of information, and in an appendix is given a long list of references to publications and papers on this subject.—*Elek. Zeit.*, August 28, September 4.

Osmium Lamp.—An article giving a report of a German daily paper concerning the osmium lamp. The German Incandescent Gas Light Company, which owns the patent right for the osmium lamp, no longer enjoys its former remarkable financial condition; it paid dividends up to 130 per cent. several years ago, 28 per cent. a year ago, and probably less this year. The chief reason is the uncertainty concerning the osmium lamp on which exceedingly sanguine expectations had been based. In the report of the company, of 1900-1901, it had been stated that it was hoped to so increase the manufacture of this lamp in the winter season as to yield profits in the new year. As recently as July last the company repeated the assertion that the lamp would be placed on the market in the coming season, and a few days ago it was stated by the company that the prices and conditions of sale have not yet been fixed. The chief obstacle seems to lie in the impossibility of constructing lamps having a sufficiently high electrical resistance, as the osmium wire is either so long or so thin that at white heat it is unable to retain its original shape. The company claims to have surmounted the difficulty.—Lond. *Elec.*, October 3.

REFERENCE.

Suspension of Incandescent Lamps.—An illustrated description of a method used by a French company for the suspension of incandescent lamps. It enables one to set a lamp in a certain position, according to the requirements of the case, and to light and extinguish it in any position. In a spherical wooden box there is a movable globe, to which is fixed the support for the lamp.—*L'Ind. Elec.*, August 25.

TRACTION.

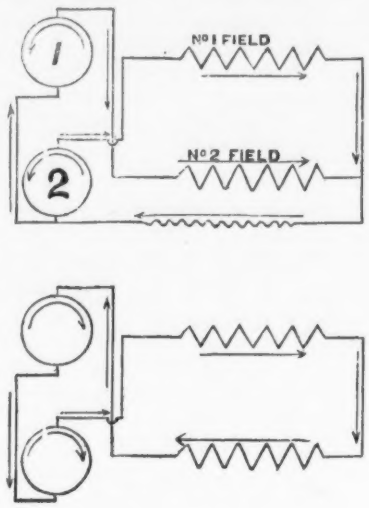
Taeggi High-Speed Telpher Postal System.—DIGBY.—An illustrated description of the scheme proposed by Taeggi for the transmission of letters, newspapers and parcels along an aerial electric railway, at speeds as high as 400 km. per hour. The system is now under the consideration of an expert committee, appointed by the Italian Postal Minister. The area to be served is divided into districts of varying importance, the less important connections branching off from the main lines. The "aerial way" consists of four wires, which also act as conductors; on the two lower wires run the roller or trailer wheels of the despatch box, while the top wires, which are placed sideward, carry the motor or driving wheels. Three other wires are the main feeders for the supply of high-tension, three-phase current of 5,000 volts to transformers, reducing the voltage to 260, from which the current is taken to the two upper and one of the two lower wires, mentioned before, for supplying the motor of the despatch box. The despatch boxes, consisting of the dust and damp-proof case of the driving motor, and the trailer box which carries the letters, are of aluminum; the weight to be carried by the aerial wires is 80 lbs., including the letters. The construction of the aerial way is shown in illustrations. Some critical remarks are added. It is doubted whether a speed of 250 miles per hour is an economic possibility, even should the unknown difficulties of current collection at such speeds be overcome. The condition of the success would lie in its having plenty of work spread over long hours, with the heavier matter, now sent by book and pencil post, sandwiched in between the rushes of business correspondence—Lond. *Eng'ing*, September 26.

Electric Brakes.—FAWCUS.—An article referring to a recent tramway accident at Glasgow. It is said that if a car can be prevented from running backwards after it has once stopped, without the use of the mechanical brake, a good deal is accomplished in the direction of security against such accidents. With the ordinary simple form of electric brake, that is, when the motors generate current to be absorbed in a resistance, the motors should be so connected that the armature of each excites the field of the other, when running in parallel, as shown in Fig. 1. If the direction of rotation be reversed, by the car running backwards and without the position of the controller handle being altered, the motors will excite and run short-circuited on one another, as shown in Fig. 2, and the car will be prevented from making any appreciable progress. In the explanation, it is assumed that the armature of one generates sufficient e. m. f. with the residual field to send a current in the opposite direction through the field of 2. This is sufficient to start the armature of 2, generating in the same direction as before (both its direction of rotation and field being reversed), and exciting field 1, whose polarity remains the same. With this arrangement it would be advisable for the motor man to always use his electric brake when stopping, and to keep his controller in the brake position until restarting the car.—Lond. *Elec. Rev.*, September 26.

REFERENCES.

Surface Contact Systems.—PAUL.—An illustrated article in which he critically discusses the Diatto system, the Dolter system and the system of the Lorain Steel Company.—*L'Ind. Elec.*, August 25.

Automobiles.—HOSPITALIER.—A very long article, in which he discusses the use of electric devices on automobiles with heat engines. The part which electricity plays in the automobile with heat engines



FIGS. 1 AND 2.—ELECTRIC BRAKES.

is that of an "elastic organ interposed between the engine and the wheels," either for simple coupling only, or for coupling and speed variation, or finally as electric transmission, the heat engine operating a dynamo the direct current of which feeds the motor or motors acting upon the wheels by more or less ingenious and more or less practical combinations and couplings. These three different applications are discussed in detail.—*L'Ind. Elec.*, August 25.

INSTALLATIONS, SYSTEMS AND APPLIANCES.

African Lighting Station.—HOHL.—A description of the electric lighting station of Lagos, which is the capital of a British crown colony in West Africa. The plant was built by the government. There are three 30-kw, 1,000-volt, single-phase alternators. For street lighting, ten circuits are used, each containing 20 incandescent lamps of 50 cp and 50 volts in series, each lamp being provided with a short-circuiting device. For house lighting, the voltage is reduced to 100, by transformers placed in houses or in substations. The price for the kw-hour is small compared with the high price for fuel; it is 14 cents, no rent being charged for the meters; the running cost of the plant is scarcely paid for, but the government is rich. In this case electric light is cheaper than kerosene, and the number of connections therefore steadily increases. Some load curves are reproduced.—*Elek. Zeit.*, August 21.

ELECTRO-PHYSICS AND MAGNETISM.

Rule of Maxwell.—BARY.—An article on Maxwell's rule, stating that any circuit traversed by a current tends to move and to deform in such a way that the flux which it surrounds becomes a maximum. He remarks that this rule is not always applicable in this form, and should be stated as follows: any current-carrying circuit tends to surround the maximum possible external flux and to assume a maximum coefficient of self-induction.—*L'Ind. Elec.*, August 25.

REFERENCE.

Terrestrial Magnetism.—The September issue contains a paper in German, by Nippoldt, on the meteorological nature of the variations of terrestrial magnetism; a note by Beattie on work in terrestrial magnetism and atmospheric electricity in South Africa; an article by Hyde on Wilson's account of Gibbs's vector analysis; two notes in French, by de Moidrey, on the amplitude of the daily oscillation of the magnetic declination and its monthly inequality, and on the secular variation of the declination at Zi-Ka-Wei, China; a biographical sketch, with portrait, of Sir Edward Sabine; a note by Hallock on the magnetic deflection of long steel wire plumb

lines, and a note by McNair on the divergence of long plumb lines at the Tamarack mine.—*Terr. Mag.,* September.

Electro-Chemistry and Batteries.

Copper Plating.—A description of the Dessolle process of copper plating, in which the electrolyte is projected under pressure against the metallic object and the anodes. The cleansed articles are placed in a preparatory "adhesion bath," and subjected to the action of a current of 30 amperes per square meter.. They are then immersed in the principal bath, in which jets of the liquid are driven against the surface and that of the anodes, which effects the removal of gas and impurities from the bath and enables a strong current to be used, so that a perfectly smooth deposit of copper is obtained. A deposit of 1/10 mm. is obtained in 1½ hours without prejudicial effect. The price of plating metals with a good deposit of copper does not exceed two francs per kilogramme of deposit, but the economic advantage of the Dessolle process is that there is perfect adhesion of the deposit, which can be made thicker and yet be durable.—*Jour. Soc. Chem. Ind.,* abstracted in Lond. *Elec.,* October 3.

Electrolytic Reduction of Nitric Acid.—Tafel.—An investigation of the alterations which nitric acid will undergo by electrolysis in the neighborhood of the cathode, considerable amounts of sulphuric or hydrochloric acid being present. A reduction will occur with most cathodes, but these are exceptions, as, for instance, platinum. The mean products of this process are ammonia and hydroxylamine, whose ratio depends on a whole series of factors, and varies to a high degree.—*Zeit. f. Anorgan. Chemie.,* 31, 3, p. 289, 1902; abstracted in *Science Abstracts,* September.

References.

Cathodic Polarization in Dilute Sulphuric Acid.—Tafel.—A German Bunsen Society paper on a method of measuring the polarization at cathodes of different materials, analogous to Caspari's method of the over voltage required to develop hydrogen at cathodes of different materials. Caspari found that of the metals investigated in pure sulphuric acid, lead and mercury show the highest over-voltage; these are the same metals which Tafel found to be the only suitable cathode materials for producing certain reductions. Tafel uses comparatively high current densities, and as anode a bright platinum pan, filled with sulphuric acid, in which the cathode is suspended in a fixed position. He says this method enables one to measure the polarization with an exactness of some thousandths of a volt.—*Zeit. f. Elektrochemie,* August 21.

Hypochlorous Acid.—Luther.—A German Bunsen Society paper, in which he shows that, on the basis of the measurements of Jakowkin on the hydrolysis of chlorine in aqueous solutions, it is possible to predetermine theoretically the electromotive behavior of hypochlorous acid. He makes some critical remarks on a recent experimental investigation of Mueller on the same subject.—*Zeit. f. Elektrochemie,* August 21.

Units, Measurements and Instruments.

References.

Electrometer.—Grimsehl.—An illustrated description of a very sensitive aluminum foil electrometer. In general it is similar to Kolbe's electrometer, but differs from it in essential details.—*Phys. Zeit.,* September 15.

Earth Inductor.—Chabot.—A brief illustrated description of a rotating earth inductor, in which the uncertain sliding contacts are entirely eliminated.—*Phil. Mag.,* October.

Miscellaneous.

Reference.

Electric Ignition.—Soulier.—An illustrated article on the electric ignition of gas engines on automobiles.—*L'Ind. Elec.,* September 10.

Uralite.

Uralite is described by Mr. O. J. D. Hughes, U. S. Consul at Coburg, Saxony, as a new fire-proof and insulating material. It is composed of asbestos fibre with proper proportions of silicate and bicarbonate of soda and a small amount of chalk. It is the invention of a Russian artillery officer and chemist named Imschenetzky. The tests described are quite striking.

New Books.

William Gilbert, of Colchester. A Sketch of his Magnetic Philosophy. By Charles E. Benham. Colchester: Benham & Co. 96 pages.

This handsome little pamphlet is particularly opportune in view of the renewed interest in the Colchester physician from the recent publication of the Gilbert Club translation of his works; indeed, the author intimates that his little book is intended as complementary to this translation, its object being to give a popular sketch of Gilbert and his philosophy.

The author says we must not look to Gilbert as a great man of science in the sense of one having a genius for research. While he corrected undoubtedly a few glaring cases of "bad observation" on the part of other investigators, his own experiments were extremely crude, and he was not always specially accurate. It is true he stands high above all contemporaries in England in the field of physical science, but what he laid the foundation of was not so much electricity as the way which magnetics and electrics ought to be studied. In other words, he was not so much a builder of science as the architect of a truly scientific spirit. His life work consisted in the doctrine, new to England, that all scientific knowledge must be founded on practical experiment and observation alone, instead of on speculations and theories evolved out of inner consciousness—a principle in which he anticipated Lord Bacon.

It is this aspect of Gilbert—as the discoverer of true methods of investigation rather than of unknown facts and phenomena—that the author presents. The titles of the several chapters are as follows: The old magnetic philosophy; the first book of "De Magnete"; magnetic motions and electric force; the magnet's directive virtue; the variation of the compass; the dip, "orbs of virtue" and the "life of the universe"; the Copernican theory.

While in warm sympathy with his subject, the author is not chary of criticism of some parts of Gilbert's great treatise, particularly the occasional inconsistent relapses into the metaphysical speculation so severely condemned in others. An interesting fact is noted that Galileo came into possession of "De Magnete" through having a copy given him by a "Peripatetick philosopher of great fame," who desired "to free his library of contagion." It may be added that Gilbert became the champion in England of Copernicus's "heretical" theories a generation before Galileo wrote the celebrated "Diologo." It is also interesting to learn that from a philosophical club which Gilbert founded in London, the Royal Society sprang.

Books Received.

Reference Library of Modern Engineering Practice—Steam, Electricity, Mechanics. Illustrating and Explaining the Theory, Design, Construction and Operation of all kinds of Machinery. By Frank W. Gunsaulus, President Armour Institute of Technology, and 25 collaborators. Chicago: American School of Correspondence at Armour Institute of Technology. Ten Volumes. About 4,000 pages and 2,000 illustrations. Price, $40.

Directory of Electrical Societies, Etc.

American Institute of Electrical Engineers, Secretary, Ralph W. Pope, 95 Liberty Street, New York. Next meeting Oct. 24, paper by C. P. Matthews on "An Integrating Photometer for Glow Lamp and Sources of Like Intensity."

National Electrical Contractors' Association of the United States, Secretary, W. H. Morton, Utica, N. Y. Next meeting, Detroit, Mich., July 15, 1903.

National Electric Light Association, Secretary, James B. Cahoon, 136 Liberty Street, New York. Next meeting, Chicago, May, 1903.

Northwestern Electrical Association, Secretary, Thos. R. Mercein, Milwaukee. Wis.

Old-Time Telegraphers' and Historical Association, Secretary, John Brant, 195 Broadway, New York.

The Electrical Trades Society (member National Electrical Trades Association), Secretary, A. P. Eckert, 39 Cortlandt Street, New York. Board of Directors meets every second Friday of each month.

Electric Storage Battery Locomotives.

By Thos. J. Fay.

IN industrial service the trolley type of locomotive is objectionable primarily because the trolley wire is more or less a nuisance and generally in the way of traveling cranes and other labor-saving devices, while the fire risk is greater than the average mill owner cares to consider, particularly in the case of cotton and flour mills. In a coal mine a trolley locomotive is quite out of the question, and, indeed, we may also consider this to be true of the storage battery type as ordinarily constructed; but storage battery locomotives can be made safe in mining work by a plan which the writer has had in mind for some little time. This consists in employing a motor of the enclosed type submerged in oil, the battery and all its connections also being in a bath of oil.

It is as far back as the year 1887 that the writer, who was at the time superintendent of the Brooklyn Incandescent Electric Light Company, then using the Knowles storage battery system, experimented with storage batteries submerged in paraffine oil. As the oil was lighter than the electrolyte, there was no displacement of the latter; and since the oil did not come into contact with the elements, there was no electrolytic splitting up of the oil into its components. A fractured strap or a broken cross bar of an element with its attendant "arc" would not produce an explosion (assuming an explosive atmosphere), because of the presence of a layer of oil separating the "arc" from the atmosphere; and, besides, the oil "dampens" the arc, thus practically preventing the occurrence of the phenomenon. Finally, it may be well to point out that the cost of the oil required is a matter of no moment, and as to the added weight, we have but to remember that weight means tractive adhesion, of which we can obtain no more than enough even if we employ the heaviest battery and a locomotive of considerable weight, provided, of course, ballasting is not resorted to. Thus, unlike in the case of the automobile battery, weight is necessary to the success of the locomotive, and the rate of discharge is, comparatively speaking, low. Moreover, a long life is only assured by the use of the more substantially constructed central station types of battery, the first cost being a matter of minor consequence, provided the results realized are thoroughly good.

This is assured if the following conditions prevail—namely, the weight on the drivers must be that which will permit of skidding of the wheels before the battery reaches a dangerous rate of discharge, assuming the most favorable condition of rail adhesion—namely, a sanded track.

There are numerous other conditions governing the service that can safely be rendered by a given locomotive, such as relate to curves,

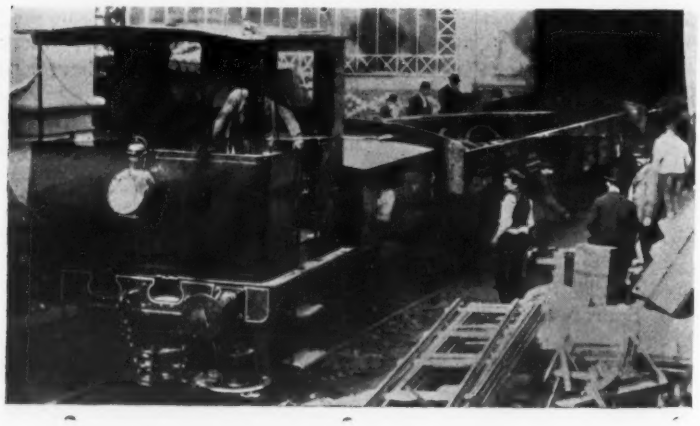


FIG. 1.—A FRENCH TYPE OF LOCOMOTIVE.

grades, track conditions, etc. The following actual tests of an electric storage battery locomotive, under conditions as stated, will illustrate the effect of gradient on battery capacity.

The weight of locomotives was 9,120 lbs., or 1,140 lbs. on each of the eight drivers. The trucks were of the radial type. The cars weighed 5,000 lbs., making a total weight of 14,120 lbs. The battery consisted of 44 cells of 9E chloride cells, and there were two 80-volt motors. The average e. m. f. was 85 volts. The current in amperes was as follows:

On a level	26	amperes.
On a 1 per cent. grade	29.4	"
On a 2 per cent. grade	33.1	"
On a 3 per cent. grade	37	"
On a 4 per cent. grade	40.8	"
On a 5 per cent. grade	44	"
On a 6 per cent. grade	47.5	"
On a 7 per cent. grade	50.6	"
On an 8 per cent. grade	53.7	"
On a 9 per cent. grade	57	"

The speed varied from 264 feet per minute on a level to 176 feet per minute on a 9 per cent. grade. The motors were series wound, two in parallel. All battery cells were in series.

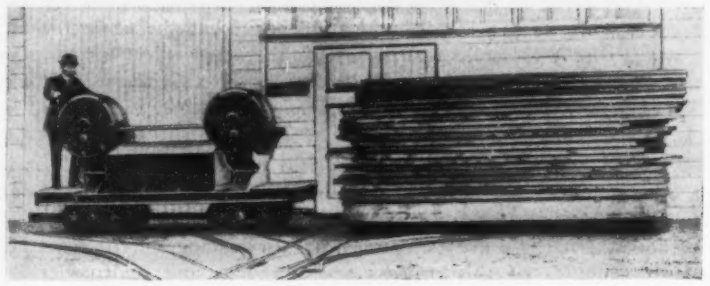


FIG. 2.—SHOP LOCOMOTIVE.

In another test with the same locomotive, all conditions were as before, excepting that the total load was increased to 30,000 lbs. The current in amperes was then as follows:

On a level	34.75	amperes.
On a 1 per cent. grade	39	"
On a 2 per cent. grade	44.5	"
On a 3 per cent. grade	48	"
On a 4 per cent. grade	53.3	"
On a 5 per cent. grade	57.5	"
On a 6 per cent. grade	61.5	"
On a 7 per cent. grade	66	"
On an 8 per cent. grade	99	"
On a 9 per cent. grade	72	"

The speed varied from 209 feet per minute on a level to 135 feet per minute on a 9 per cent. grade.

In a third test with a total load of 45,000 lbs. the current on a level was 42 amperes for a speed of 142 feet per minute. In a fourth test with a total load of 100,925 lbs, the current on a level was 70 amperes, with a speed of 80 feet per minute.

The capacity of the battery on a three-hour basis was 210 ampere-hours, so that the locomotive hauling 100,925 lbs. (total load) on a level, at a speed of 80 feet per minute, was doing its maximum safe work. The locomotive tested, which is illustrated in Fig. 2, was manufactured by the C. W. Hunt Company, under the direction of the writer. This locomotive, unlike conventional types, is so designed that the driving motors with their speed-reducing gear cases are located on upward projecting saddles above the platform of the locomotives, and by means of "Renold" chains the power is transmitted to the four driving axles. The gear cases, one at each end, are of agreeable appearance. The internal arrangement of the gearing is as shown in Fig. 3. This arrangment of gearing and motors is such that the trucks are truly radial, and with wheel base centers approximating 38 inches.

The locomotives will turn a curve of 12 feet radius with scarcely any increased energy consumption. A result such as this will appeal to even a casual observer, for it has been fully demonstrated on more than one occasion that an ordinary 40-foot, rigid wheel-base locomotive will leave the track almost every time, with a radius of curvature of more than double 12 feet, when running at even a very low speed. It is a fairly established fact that the radius of curvature for a rigid wheel-base locomotive must be not less than six times the rigid wheel-base centers, and for a 13-foot platform it would not be even allowable practice to space the wheels less than 4 feet 6 inches apart, giving $4.5 \times 6 = 27$ feet radius of curvature of the track. Fig. 4 illustrates an experimental 4-foot driver, rigid wheel-base locomotive. That this locomotive would serve in cases where the track is straight is fair to presume, but not in cases involving curves of short radius.

In concluding this part of the subject it is well to point out that the locomotive requiring the least expenditure of energy with a given load and speed on a given curve will run most free on a tangent, and afford more adequately protection to the battery against undue discharges, besides assuring a greater radius of action per battery charge;

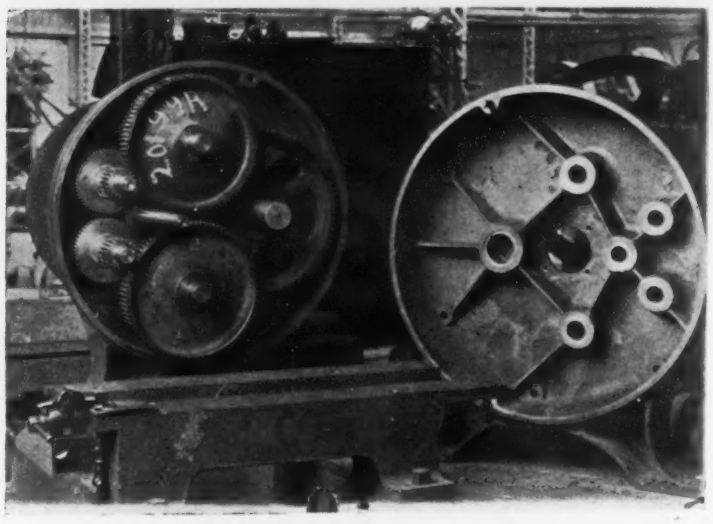


FIG. 3.—GEAR REDUCTION.

or what amounts to the same thing, a given radius of action for a less first cost of battery, although it is the writer's judgment that a liberal weight of battery is the best guarantee of long life and a satisfactory performance throughout that life.

That first cost is a matter of minor concern may be realized by reference to the following case: The operator of a cotton mill, who could not use a steam locomotive because of the fire risk, and would not employ a trolley locomotive for the same reason, has for a long time employed about 30 spans of horses in hauling raw material to his mill —about a mile—and finished product to the freight station. It is safe to assume that the first cost of his equipment is not less than $20,000, and it is equally safe to say the depreciation is 20 per cent.; so that, by purchasing a storage battery locomotive of 15 tons weight, capable of displacing his entire animal equipment, at a first cost to him of not over $10,000, he took no risk whatever. The locomotive will do all the work and employ no more than two men, whereas the animal equipment requires from 20 to 35 men. Moreover, with so many teamsters, labor trouble alone is a factor. The depreciation of the locomotive will not, in any case, exceed $1,000 per annum, but even

FIG. 4.—STORAGE BATTERY LOCOMOTIVE.

at double that amount, the cost of maintenance would be a mere incident.

Fig. 5 illustrates a 15-ton, storage battery locomotive, the general data of which are as follows: Length over all, 22 feet 6 inches; width over all, 8 feet; wheel-base centers, 8 feet 6 inches; total weight, 15,000 lbs.; battery, 48 cells, about 500 ampere-hours at an 8-hour rate; motor equipment, two 15-hp railway motors. The battery is arranged in two divisions, set up in lead-lined tanks, as shown in the plan (Fig. 6), which gives details of the connecting straps and cover. The height over all can be any desired amount, 20 inches being an excellent value. The cells are arranged in two lead-lined suitably drained and ventilated boxes, with top covers and stone insulating rests and porcelain spacers for the jars.

The motors are connected to reducing gear cases in the cab, where they are under the eye and immediate care of the motorman, the power being transmitted to the drivers by means of "Renold" chains. The rolling stock, etc., are all standard. The driving wheels are 33 inches in diameter. The speed of the locomotive was designed to be 352 feet per minute, maximum. The battery and its accessories amounted to about one-third of the total weight, and costs about 25 per cent. of the selling price. This locomotive is designed to operate on the standard broad-gauge track (4 feet 8½ inches), and will handle with ease two "Mark Hanna" coal cars, making a total load of about 175 tons. For good work it is generally a safe assumption that this type of locomotive is a better paying venture than a steam switching engine. One man (not a licensed engineer) can run the locomotive, and, besides, there is no "firing up" to do, no steam gauge to watch, no water to "pump up," and, last but not least, the locomotive is always ready. The charging being done on the "floater" system is automatic and done at odd times when the locomotive is standing idle.

The battery output in work of this class will be about as shown in the accompanying table, but will vary with conditions. The actual total output in a day, under the average conditions will never, it is thought, equal the battery capacity. Locomotives in industrial service are never called upon to work continuously.

Battery Output in Watts per Ton-Mile, Dry Track.

Level	112	watts.
1 per cent. grade	192	"
2 per cent. grade	272	"
3 per cent. grade	392	"
4 per cent. grade	472	"
5 per cent. grade	552	"
6 per cent. grade	632	"
7 per cent. grade	712	"
8 per cent. grade	792	"
9 per cent. grade	872	"
10 per cent. grade	952	"

At this rate the locomotive alone would take 14,280 watt-hours per hour from the battery on a 10 per cent. grade, at a speed of one mile per hour; thus the battery would be exhausted in four hours in mounting a 10 per cent. grade at that speed. It is plain that gradient is the bane of the battery, and a nearly level track is much to be desired. The speed of one mile per hour is fast enough, in practice, for this kind of work, drawing a full load; when running light on a level, with suitably designed series-wound motors, the speed will be

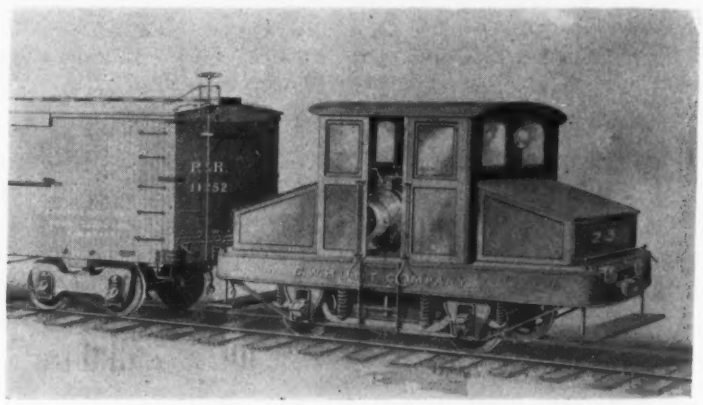


FIG. 5.—FIFTEEN-TON LOCOMOTIVE.

about four miles per hour, and it is now a fully established fact that for industrial service, to run at a greater speed is a hazard.

The speed control of shop locomotives is a matter of some moment, and a matter that the writer arrived at rather more by experiment than otherwise. Following are the data of a test made on a 5-ton "Hunt" shop locomotive, built for use in the shops of the Westinghouse Electric and Manufacturing Company, a view of which is given in Fig. 7.

With the locomotive only, on a level, first notch, the current was

11 amperes, and the speed 1.2 miles per hour; second notch, 18 amperes, 3 miles per hour; third notch, 30 amperes, 5.5 miles per hour. With the locomotive and 9 tons of car load on a level, at first notch the current was 15 amperes and the speed 1.1 mile per hour, second notch, 37 amperes, 2.8 miles per hour; third notch, 72 amperes, 5 miles per hour. With the locomotive and 20 tons of car load on a

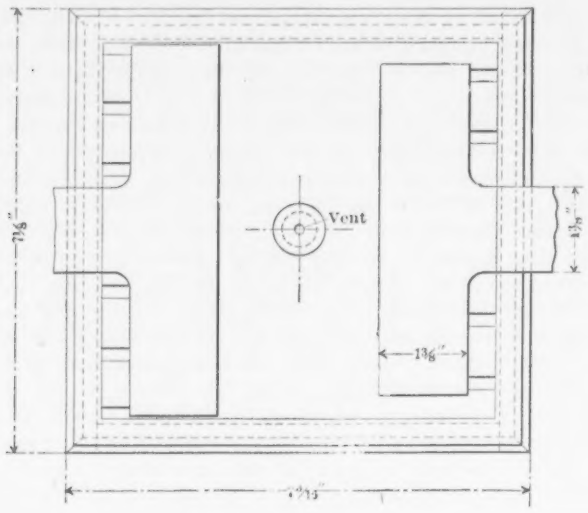


FIG. 6.—BATTERY BOX.

level, at the first notch the current was 10 amperes, and the speed .95 mile per hour; second notch, 40 amperes, 2.6 miles per hour; third notch, 95 amperes 4.3 miles per hour.

The battery consisted of 42 cells of chloride and tested 96 volts on open circuit, and at a discharge rate of 40 amperes the battery registered 90 volts. The locomotive was equipped with two Westinghouse vehicle-type motors, wound for 75 volts. The speed, on the whole, is too high for service in the usual run of shops; the speed control, however, proved to be very satisfactory, and for the Westinghouse shops (covering an unusual area), the speed realized was very acceptable. This small locomotive is sometimes used to haul a standard broad-gauge freight car, and does the work with ease, the narrow-gauge tracks on which the locomotive runs being laid between the broad-gauge tracks that connect the main line of the P. R. R. with the shops.

A draw-bar pull test of this locomotive showed the pull starting to be 1,200 pounds; running on curve of 12-foot rad, 600 opunds; running on a tangent, 400 pounds. The total load of the locomotive was 10,000 lbs., and that of the ten cars and load, 14,000 lbs., or a total of 24,000 lbs. This is not a test showing the limit of draw-bar pull,

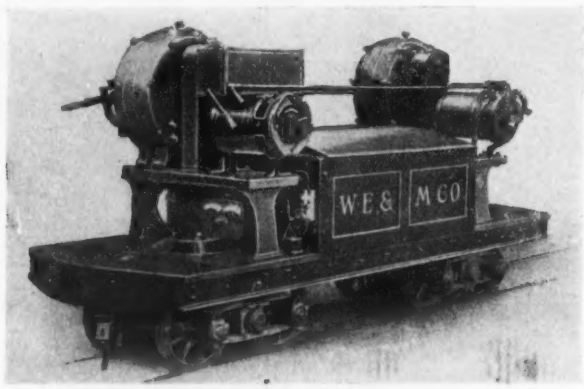


FIG. 7.—FIVE-TON SHOP LOCOMOTIVE.

but rather a test showing the resistance offered by the stated load. As a matter of fact, a 5-ton locomotive might under fair conditions be expected to perform about as follows:

On a level track, 1 per cent. grade, 2 per cent. grade, 3 per cent. grade, 4 per cent. grade and 5 per cent. grade, the pull at the drawbar would be 1,300 lbs., 1,200 lbs., 1,100 lbs., 1,000 lbs., 900 lbs., and 800 lbs., respectively. This is the running drawbar pull, in pounds; the starting pull being somewhat more and limited by the wheel slip.

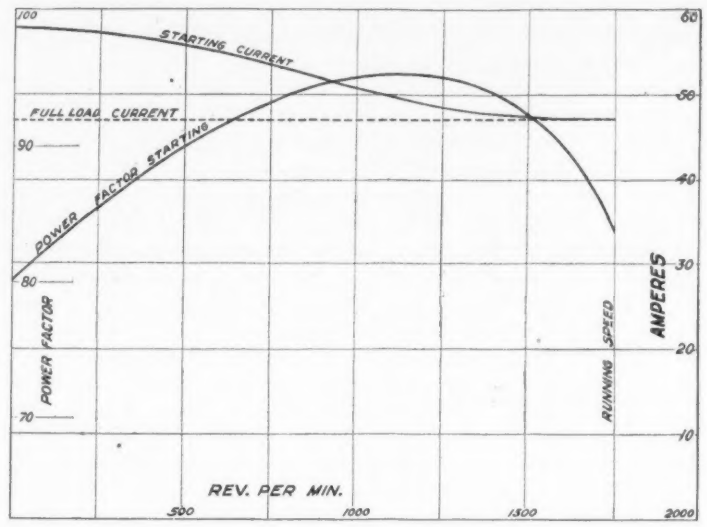
The track is an important adjunct in industrial railway work, and it is safe to say that the rails should be no lighter than the following: For a 3-ton locomotive, 12 lbs. per yard; 5-ton locomotive, 16 lbs. per yard; 7½-ton locomotive, 20 lbs. per yard; 15-ton locomotive, 24 lbs. per yard. Rails lighter than 12 lbs. per yard should not be used at all. Locomotives heavier than 10 tons will scarcely ever be required in industrial service. The spacing of ties should be close if a good track is desired, and the "ballast" might best be of broken stone, well tamped.

There are numerous other matters of interest in connection with this phase of industrial progress, not now to be mentioned for lack of space, the object of this article being to present real practical data bearing on the questions of speed, hauling capacity and energy consumption of storage-battery types of locomotives.

Holding Down the Starting Current of Single-Phase Motors.

One of the great objections to the installation of alternating-current motors on general service circuits has been the abnormal starting current and the low power factor of this starting current. This objection has existed with both the polyphase and single-phase motors. The builders of both forms of motors have sought to minimize the difficulty by the use of auto-transformers in starting, thus reducing the voltage applied to the motor, and in consequence thereof the starting current.

The Wagner Electric Manufacturing Company have just announced in connection with its single-phase motors, the introduction of a line of non-inductive starting rheostats, the use of which not



CURVES OF STARTING CURRENT AND POWER FACTOR.

only eliminates the objectionable starting current, but also performs the very desirable function of running the power factor of the starting current to a very high point. The accompanying diagram illustrates the effectiveness of the use of such a starting device, the curves referring to a 7½-hp motor operating at 208 volts and 60 cycles. It will be observed that the starting current at no time exceeds the running current by more than 25 per cent. for full-load starting torque. The power factor of the starting current also is never less than the power factor of the running current, and throughout a great part of the starting range it is very much higher than the running power factor.

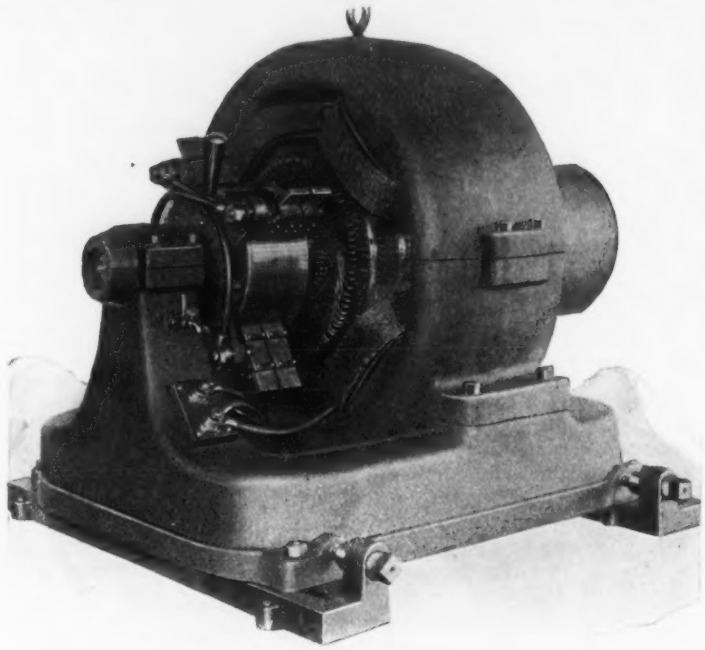
The starting rheostats by which this improvement is accomplished are ordinary non-inductive boxes, corresponding in practically every respect to the starting boxes for direct-current motors. They are practically supplied without the automatic spring release, the object of this omission, as compared with the direct-current starting boxes, being to avoid the shutting down of the motor in case of circuit switching at the central station. The motors of the Wagner Company may be started with or without these boxes, the ability to do so arising from the fact that the motors are entirely automatic in every respect.

In the smaller sizes, the majority of central stations prefer to install single-phase motors of the Wagner Company's type, without auxiliary starting devices of any kind. It will prove of advantage, however, with the larger motors, to use the rheostats; and as their use does not entail any large additional cost, it is likely that the

installation of such motors with rheostats of larger sizes will find very general application. These rheostats are connected in the supply circuit, between the main switch and the motor.

Federal Multipolar Belted Generator.

The multipolar belted generator, shown in the cut herewith, is made by the Federal Electric Company, Erie, Pa., the winding being either compound or shunt wound. The poles are of laminated soft



MULTIPOLAR GENERATOR.

steel, with removable pole shoes. The pole shoe supports the field coils, which are also removable. The armature is iron-clad, wound with formed coils. The dynamo is mounted on sliding rails, having adjusting screws for tightening the belt. These machines are made in sizes of 23, 33, 40 and 60 kw, slow speed. The same type is made for moderate speed, with poles of laminated soft steel and removable pole shoe. The pole shoe supports the field coils, which are easy of access and removable. The armature is iron-clad, wound with formed coils. The machines are mounted on sliding rails, having adjusting screws for tightening the belt, and are made in sizes of 30, 45, 55 and 70 kw.

Guy Anchor.

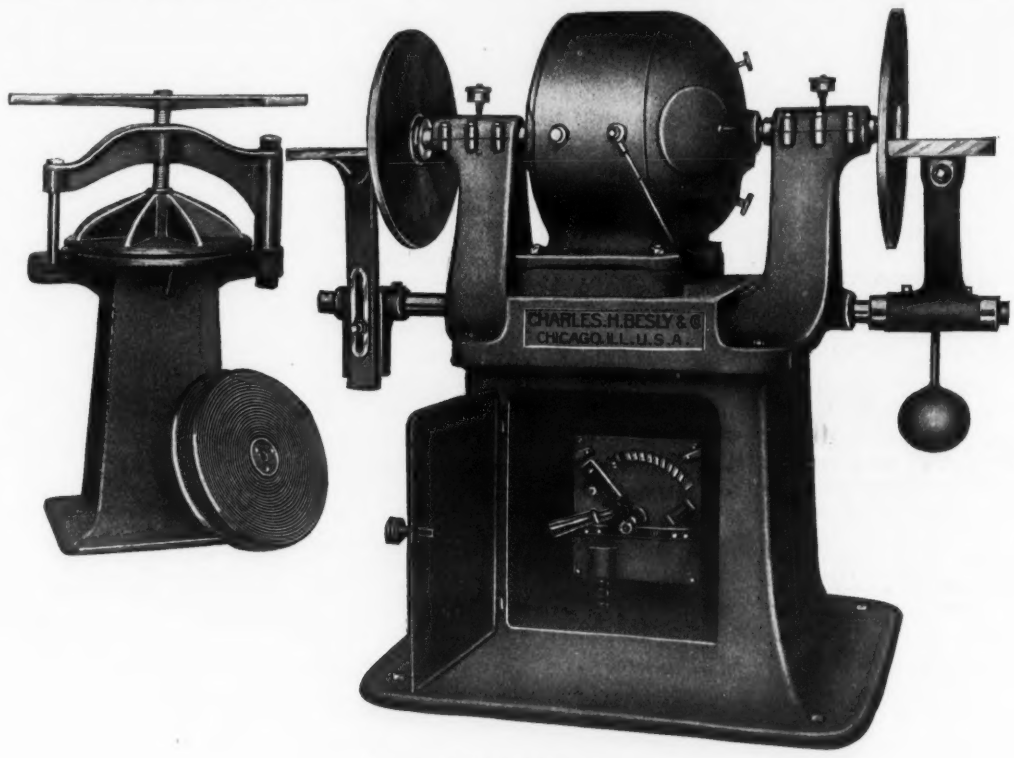
The two illustrations below show a guy anchor which is in considerable use, particularly in the West, and made by W. N. Matthews & Bro., Security Building, St. Louis. Two types of the anchor are shown, that of Fig. 1 being employed for straight line guying and on curves where there is not a great strain. Fig. 2 shows a larger type, which is employed for heavy dead-ends and corner strains, and for smoke pipes, bridge and trestle work where a great strain is encountered. Either anchor can be placed into position without digging, filling or tamping, and as they are practically in one piece, it is claimed that they will last indefinitely. Actual tests with a 5-inch anchor of the smaller type, which has a ⅜-inch wrought-iron rod, showed that a pull of 8,000 lbs. was necessary to draw it from its position from a hole bored three feet into sandy soil, and a correspondingly greater strain when bored into clay. This pull is 3,000 lbs. greater than the breaking strain of a ⅜-inch stranded guy. A 12-inch guy anchor withstood a pull of 36,000 lbs. when bored into five feet of clay. The reason that so great a pull is required to withdraw these anchors is because they are bored into the ground without otherwise disturbing it, in much the same manner that a wooden screw is put into a board.

Motor-Driven Grinder.

The accompanying illustration shows a motor-driven Gardner grinder, manufactured by Messrs. Charles H. Besly & Co., Chicago, Ill., for the United States Mint, at Philadelphia, and driven by a 5-hp Crocker-Wheeler motor.

Gardner grinders are in use in many large manufacturing shops, among which may be mentioned those of the Allis-Chalmers Company, the Bullock Electric Company and the Northern Electric Company. These machines may be direct-connected to the motor, as in the example shown, or driven from line shafting. In the machine illustrated, the controlling apparatus is contained in the base where, when the door is closed, it is protected. The motor is mounted between the two grinding-wheel bearings, thus giving a firm construction.

FIGS. 1 AND 2.—GUY ANCHORS.



MOTOR-DRIVEN GRINDER.

NEWS OF THE WEEK.

Financial Intelligence.

THE WEEK IN WALL STREET.—Time money closed at 6 per cent. for all dates, the tendency of the market, on the whole, being in the direction of improvement. There was renewed activity and strength of the stock market as a result of the settlement of the coal strike and the easing off of money rates. The anthracite stocks naturally advanced, but the improvement extended throughout the entire list. The United States Steel stocks, after a decline in both common and preferred, rallied from renewed inside support. All of the electric and traction stocks showed substantial gains, as noted below. Brooklyn Rapid Transit closed at 64¼, which was only ¼ point below the highest figure of the week, representing a gain of 2⅜ points. Metropolitan Street Railway made a net gain of 5 points, closing at 141½, the lowest quotation being 135. The sales of this stock aggregated 19,800 shares. On transactions of 11,600 shares, General Electric made a net gain of 11¼ points, closing at 188½, which was the highest figure of the week, the lowest being 170. Westinghouse, common, kept at 217, which represents a net gain of 5½ points, while first preferred receded 10 points, closing at 215. Western Union closed with a net gain of ⅞ points, at 92½; Commercial Cable closed at 175, a net gain of 4½ points, and American District Telegraph at 40, a net gain of 1½ points. American Telephone and Telegraph lost 1½ points net, closing at 162; 625 shares of this stock were dealt in. Following are the closing quotations of October 21:

NEW YORK.

	Oct. 14.	Oct. 21.		Oct. 14.	Oct. 21.
American Tel. & Cable.	92	92	General Electric	181	187
American Tel. & Tel.	163	164½	Hudson River Tel.	—	—
American Dist. Tel.	37	39⅝	Metropolitan St. Ry.	138	139¼
Brooklyn Rapid Transit	62	63	N. E. Elec. Veh. Trns.	—	⅜
Commercial Cable	—	—	N. Y. & N. J. Tel.	—	162
Electric Boat	23	28*	N. Y. E. V. T. Co.	12¼	13¼
Electric Boat pfd.	35	45*	Tel. & Tel. Co. Am.	—	—
Electric Lead Reduc'n.	3¼	3⅝	Western Union Tel.	90⅞	91¼
Electric Vehicle	4	5	West. E. & M. Co.	210	210
Electric Vehicle pfd.	9	13			

BOSTON.

	Oct. 14.	Oct. 21.		Oct. 14.	Oct. 21.
American Tel. & Tel.	163½	165	Western Tel. & Tel. pfd.	—	100½
Cumberland Telephone	—	—	Mexican Telephone	2	2¼
Edison Elec. Illum.	—	—	New Eng. Telephone	135	139
Erie Telephone	—	—	Westinghouse Elec.	104	108½
Western Tel. & Tel.	—	—	Westinghouse Elec. pfd.	104½	108½

PHILADELPHIA.

	Oct. 14.	Oct. 21.		Oct. 14.	Oct. 21.
American Railways	—	—	Phila. Traction	98	98½
Elec. Storage Battery.	—	—	Phila. Electric	8 11/16	8⅝
Elec. Storage Bat'y pfd.	—	—	Pa. Elec. Vehicle	—	1
Elec. Co. of America.	9¼	9½	Pa. Elec. Vehicle pfd.	—	—

CHICAGO.

	Oct. 14.	Oct. 21.			
Central Union Tel.	—	—	National Carbon pfd.	99	99½
Chicago Edison	—	—	Northwest Elev. com	—	—
Chicago City Ry.	210	212	Union Traction	17	17¼
Chicago Tel. Co.	—	—	Union Traction pfd.	49	50
National Carbon	31⅞*	30			

* Asked.

BOSTON EDISON ANNUAL.—The annual report of the Edison Electric Illuminating Company, of Boston, for the year ended June 30, 1902, is issued. The operations of the company for the last two fiscal years are given in the following table, and include, for the sake of comparison, the Boston Electric Light Company and the Suburban Light and Power Company:

	1902.	1901.		Changes
Gross	$2,460,158	$2,367,359	Inc.	$92,799
Expenses	1,510,427	1,449,629	Inc.	60,798
Net	$949,731	$917,730	Inc.	$32,001
Other inc.	25,981	13,948	Inc.	12,033
Total inc.	$975,712	$931,678	Inc.	$44,034
Int. and divs.	859,614	879,285	Dec.	19,671
Surplus	$116,098	$52,393	Inc.	$63,705

Lamps and motors connected, as of June 30:

	1902.	1901.	1900.
Incandescent lamps	442,034	247,935	211,471
Arc lamps	8,548	2,503	2,131
Motors, horse-power	19,130	10,651	9,428

Of the increase shown for the fiscal year just closed 112,754 incandescent lamps, 5,128 arc lamps and 5,408 horse-power of motors were added in the purchase of the Boston Electric Light Company, and 22,812 incandescent lamps, 356 arc lamps and 772 hp of motors were added in the purchase of the Suburban Light and Power Company, showing an increase in new business for the year of 58,533 incandescent lamps, 561 arc lamps and 2,299 hp of motors.

Assets:—	1902.	1901.
Installation	$11,951,626	$5,708,060
Liverpool wharf	225,912	225,912
Cash on hand	165,914	64,557
Stock on hand	361,160	78,440
Notes and accounts rec.	246,778	121,366
Open accounts	37,613	88,152
Total	$12,989,005	$6,286,487
Liabilities:		
Capital stock	$7,850,400	$4,310,500
Tr. mort. bonds	1,250,000	180,000
Notes and accounts paid	1,247,789	792,177
Dividends payable	196,260	107,762
Install. new stock	.....	.....
Res. for maint.	654,000	506,000
Sundry open accounts	.....	41,403
Premium on new stock	1,660,387	333,535
Accrued interest and taxes	69,217	.....
Profit and loss	60,951	15,109
Total	$12,989,005.	$6,286,487

During the year the purchase of the Boston Electric Light Company was completed. The affairs of the Boston Company came under the management of this company early in October of last year. The acquisition of the Suburban Light and Power Company was also decided upon during the year, and all the property and assets of that company were purchased for cash, and its affairs turned over to this company in September of last year. Property was purchased in Central Square, East Boston, and in Roxbury, for two additional substations, and suburban offices were opened in East Boston, Dorchester and West Roxbury.

BIG TELEPHONE MORTGAGE.—Capitalists of Baltimore, Washington and New York City have recorded a blanket mortgage of $100,000,000, covering all the property of the International Telephone Company of America, to the Trust Company of the Republic. The International Telephone Company is a concern recently incorporated in Delaware. Its officers, as stated in the incorporation papers filed by Josiah Manvel, as attorney, at Wilmington, on May 15 last, are: President, S. B. Rhinehart, a banker, of Waynesboro, Pa.; treasurer, Ehlem B. Harrison, of Baltimore; secretary, Henry F. Fahey, of New York, and assistant secretary, J. Miller Kenyon, of Washington, D. C. On September 25 the same attorney had a deed of trust recorded at Wilmington for $1,000,000, to secure an issue of bonds amounting to $100,000,000, said to have been chiefly underwritten by New York, Baltimore and Washington capitalists. It was stated that the company expects to enter the telephone business as a rival to the Bell system, and hopes to place the cost of telephone calls at as low a rate as that charged for mailing a letter. The fees to be paid the State of Delaware for incorporating the company were said to approximate $30,000. The Trust Company of the Republic is a new company, organized March 28. Its directorate includes George J. Gould, former Controller of the Currency James H. Eckels, Stuyvesant Fish, Thomas D. Crimmins, Perry Belmont, George C. Boldt and other prominent capitalists.

DIVIDENDS.—The directors of the American Light and Traction Company have declared the regular quarterly dividend of 1½ per cent. on the preferred stock, payable November 1. A semi-annual dividend of $3.50 has been declared on the preferred stock of the United Electric Securities Company, payable November 1. The directors of the Columbus Railway Company have declared the regular quarterly dividend of 1¼ per cent. on the preferred stock, payable November 1. The directors of the International Steam Pump Company have declared the regular quarterly dividend of 1½ per cent. on the preferred stock, payable November 1. The Edison Electric Illuminating Company, of Boston, has declared a regular quarterly dividend of 2½ per cent., payable November 1. The regular quarterly dividend of 1½ per cent. on West Chicago Street Railway, guaranteed by the Union Traction Company, has been declared.

GENERAL ELECTRIC RIGHTS.—A special from Boston announces that General Electric stockholders will probably be the recipients of valuable rights in connection with a new company which is being formed by General Electric interests to take over the Curtis steam turbine patents, which it has developed into a commercial success. Stockholders will probably be given the right to subscribe to this new stock, pro rata, in proportion to their present holdings.

GENERAL CARRIAGE TROUBLES.—Mr. O. F. Thomas, receiver for General Carriage, says he is preparing counter suits against Mr. Joseph Leiter and Mr. Joseph H. Hoadley, to force them to account for $20,000,000 in stock of the Carriage Company and for its charter.

ELECTRIC RAILWAY STOCK INCREASES.—Dispatches from St. Louis state that the St. Louis and Suburban Railway has voted to increase its capital from $3,000,000 to $7,500,000, and to issue $7,500,000 bonds. Approval by the Massachusetts Railroad Commissioners is noted of the issue of $948,700 additional stock by the Old Colony Street Railway, and a similar increase by the Boston and Northern Street Railway. Current reports are that the capital stock of the New York and Port Chester Railroad Company is to be increased from $250,000 to $12,000,000.

BELL IN NEW YORK.—An officer of the Bell Telephone Company is quoted as saying: "The report that several independent telephone companies, including Keystone, have planned to enter New York City in competition with the Bell Company cannot be considered in any other light than a fairy tale by those who are posted on the present New York situation. No company could possibly compete with Bell in New York without first laying a complete system of conduits. The installation of such a system in New York would cost at least $10,000,000. We have now about 81,000 telephones in New York, and there, as here, we have not a single pole line in the city proper. People do not seem to be able to comprehend that pole telephone lines in the largest cities are now practically unknown."

Commercial Intelligence.

THE WEEK IN TRADE.—In the settlement of the coal strike, the only unfavorable feature in general trade and industry disappears. All other trade developments of the week were favorable, says *Bradstreet's*. Retail trade has generally improved in most all sections, and jobbing demand is also better, particularly in the West, where reorder business is noted in larger volume than usual. Country collections have been good, and money has tended to ease up, particularly in speculative circles. The strength of the cereals is a noteworthy feature in the general situation. Business is improving on the Pacific Coast, and Southern trade advices are more cheerful. Improvement in the iron trade, as a result of the probable settlement of the coal strike, is as yet a matter of sentiment, but with the free movement of coal, eastern iron furnaces now banked are expected to resume operations. No loss of strength is shown in heavy goods; in fact, the tendency has been upward. Striking advances are shown in nearly all lines of iron and steel, as compared with a year ago. In finished materials similar heavy advances are noted, the exceptions being found in sheets, wire nails and tinplates, which are generally lower. In the copper market, business was at a standstill. Standard Lake sold at 11.75c., and electrolytic is quoted at 11.50c. @ 11.60c. The business failures for the week ending October 16, as reported by *Bradstreet's*, numbered 203, as against 170 the week previous, and 198 the corresponding week in 1901.

CHLORIDE BATTERY IN ENGLAND.—Soon after the incorporation of the Electric Storage Battery Company, in Philadelphia, a company was formed in England under the name of the Chloride Electrical Storage Syndicate, Limited. This company acquired all the patents and improvements, past and future, of the Electric Storage Battery Company, for the world—outside of the United States and Canada. Electrical development has been very slow in Great Britain, so that the company has only very recently reached a dividend-paying basis. That a vast amount of electrical work is to be done in Great Britain in the next few years is shown by the very large works put up by the British Westinghouse Company, the British Thomson-Houston Company, in Manchester and Rugby, by Dick, Kerr & Co., by Siemens Bros., and others. The Electric Storage Battery Company seeing the opportunity for a large and profitable business, not only in England but in other countries, where the low price of labor and material existing in Europe makes it possible to compete with storage batteries manufactured in America, decided to purchase control of the English company. This has been done, on a satisfactory basis, so that the Electric Storage Battery Company will now realize large profits from the English business, and will also be able to sell batteries in foreign countries and have shipments made from England. It expects thus to be in the very strongest possible position to handle the bulk of the business of the world.

TELEPHONIC PLANS.—A dispatch from Washington, D. C., of October 11, says: "The International Telephone Company, of Dover, Del., has bought the abandoned car barns of the Washington Traction Company, in Georgetown. The property embraces ten acres of land and several large brick buildings, which, it is said, the new owners intend to convert into shops for a telephone factory, with a capacity of 10,000 telephones a day. The matter is discussed here, and is significant of the truth of the great gossip going around of late about the formation of a corporation to control the telephone, electric light and street car service of Baltimore, Washington, Philadelphia and Wilmington, Del. It is said that the company will put in operation a telephone system that will fix a rate of two cents for telephone messages." This sounds like a "very large order."

THE ELECTRICAL EQUIPMENT COMPANY, Suite 939 Monadnock Building, Chicago, has been awarded a contract for the complete installation of a lighting plant for the City of Washington, Ia. The equipment includes a Westinghouse three-phase, 60-cycle generator, direct connected to an Ideal engine. Work is now under way, and the plant will be in operation about January 1, 1903. The same company has also been awarded a contract for the complete installation of a water-power electric transmission plant for the Rouge River Light and Power Company, at Rockford, Mich. The equipment includes two General Electric generators and various motors, ranging in size from 10 to 50 hp. The plant will be in operation December 1, 1902.

THE STEAM AND ELECTRIC EQUIPMENT CO., Pittsburg, Pa., reports for the past week the following orders: One Stirling boiler, 100 hp, sold Knott & Van Arnam Manufacturing Company; one 125-ampere generator, sold Ampere Electric Company; one complete installation, ventilating fans and Wagner motors for ventilating a large Pittsburg building. A consignment of motors sold to the Cohen Automatic Switch and Signal Company; Wagner alternating motor, 15 hp, sold to the Republic Beating Company, Akron, Ohio. They report business brisk.

BALL ENGINE ORDERS.—The Temple Court Building, of Denver, Colo., has recently put in operation a very complete electric plant. The engines, which were furnished by the Ball Engine Company, Erie, Pa., are direct connected to General Electric generators. The outfit furnishes power for both lighting and elevators. The John Deere Plow Company, Kansas City, Mo., has recently installed an electric plant, consisting of two Ball engines, direct connected to General Electric generators. A new electric plant has been put in operation at Wilburton, Indian Territory. The Ball Engine Company furnished the engine.

SPRAGUE ELECTRIC COMPANY.—The annual meeting of the stockholders of the Sprague Electric Company was held Tuesday, October 14, 1902, at the office of the company, in Watsessing, N. J. The following directors were elected for the ensuing year: Messrs. Allan C. Bakewell, D. C. Durland, S. M. Hamill, J. R. Lovejoy, John Markle, J. R. McKee and E. G. Waters.: At a meeting of the directors, held later in the day, officers were elected as follows: President, Allan C. Bakewell; first vice-president, S. M. Hamill; second vice-president, D. C. Durland; secretary and treasurer, Harry R. Swartz.

THE ELECTRIC CARRIAGE CALL COMPANY has put its system in operation at the Metropolitan Opera House, and the device was so successful that the management has asked for a five-year contract. Since then it has closed contracts to install this apparatus at Daly's Theatre, Wanamaker's, Empire Theatre, Knickerbocker Theatre, Garrick Theatre, and through its agent, the National Electric Supply Company, of Washington, D. C., the New National Theatre and the Columbia Theatre. Orders come so rapidly that the factory is working day and night to get the apparatus out.

THE GOODALL WORSTED COMPANY, of Sanford, Me., is building a large addition to its present works, and has found it necessary to considerably enlarge the power plant. A recent purchase from the Westinghouse Electric and Manufacturing Company includes a 400-kw, two phase, alternating-current generator, which will be belted to an 800-hp Brown engine. The generator will furnish power to all departments of the plant by means of Westinghouse induction motors, and will also provide current through transformers for lighting at 104 volts..

THE ARNOLD ELECTRIC POWER STATION COMPANY, of Chicago, is acting as consulting engineer for the DeKalb-Sycamore Electric Company, of DeKalb, Ill., in the matter of rebuilding its central power plant to provide for its increasing business, and to furnish power for the interurban electric line now being constructed between DeKalb and Sycamore.

BROOKLYN SUBSTATION.—The Brooklyn Heights Railroad Company, Brooklyn, N. Y., will equip a substation on Sand Street, between Washington and Adams. It is the intention to construct a combined rotary and battery substation, which will contain 6,000-kw rotary capacity. Mr. C. E. Roehl is engineer of power transmission for the company.

General News.

THE TELEPHONE.

NEW DECATUR, ALA.—The City Council has given sixty days' notice to the Southern Bell Telephone Company to remove its poles, wires, instruments, etc., from the city. Mr. James E. Brailey and others have been granted a franchise to establish a telephone system in this place.

AUGUSTA, GA.—The City Council has adopted an ordinance granting the Bell Telephone Company permission to construct underground conduits for telephone wires.

AUGUSTA, ILL.—The Augusta-Bowen Mutual Telephone Company, Augusta, has been incorporated, capital $1,000, to operate a telephone system. Incorporators: George A. Miller, Isaac Winfield and Henry Williard.

CHICAGO, ILL.—The Illinois Telephone and Telegraph Company has leased a building on Fifth Avenue for a term of five years beginning Sept. 1, at an annual rental of $6,000. The building is to be remodeled for the purpose of a telephone exchange.

CARLINVILLE, ILL.—W. J. Finch has purchased the Chesterfield Telephone Company and assumed charge. The company has recently completed new lines, connecting Chesterfield, Carlinville, Medora, Kemper, Brighton, Piasa and all towns in the county having independent lines.

CHICAGO, ILL.—Another $1,000,000 of Chicago Telephone Company stock has been issued. This is the third installment of that amount put out this year under the act of the stockholders at the last annual meeting, authorizing the issue of $3,000,000 to pay for extensions and improvements to the company's lines.

INDIANAPOLIS, IND.—The Providence Telephone Co., of Providence, Ind., has been incorporated, with a capital stock of $5,000.

GREENWOOD, IND.—The Greenwood Telephone Company has filed additional articles of incorporation providing for the extension of its service and improvement of its plant and increasing its capital stock from $6,000 to $10,000.

INDIANAPOLIS, IND.—The Wilkinson, Simmons & Wood Telephone Company, of Wilkinson, Ind., has been incorporated, with a capital stock of $210,000. The incorporators are: John W. Reeves, W. H. Himmons, W. D. Thomas, G. H. Jackson and Walter Woods.

MONETA, IA.—The O'Brien County Telephone Company has been incorporated at Moneta with a capital of $10,000.

SEBREE, KY.—The plant of the Sebree Independent Telephone Company has been damaged by fire to the extent of $12,000. There was no insurance.

RICHMOND, KY.—The franchise for the new independent telephone system has been sold by the City Council to E. Tutt Burnam. Work will begin on the new plant within ninety days.

WESTBROOK, ME.—The Westbrook Telephone Company has applied for a franchise here.

BALTIMORE, MD.—The Chesapeake & Potomac Telephone Company is having plans prepared for a new branch telephone exchange to be erected in this city at the corner of Madison and Calvert Streets at a cost of $175,000. Mr. C. D. W. Eidlitz, of New York, is the architect. The exchange will be modern throughout and the switchboard and telephone equipment, it is stated, will cost $100,000. The exchange will have a capacity of 2,000 lines and will relieve the present St. Paul and Madison districts. The company is just completing the work of laying 60 miles of conduits under ground.

YPSILANTI, MICH.—Mayor Dawson has announced his veto of the resolution granting an independent telephone franchise to Shelly Hutchinson and associates. An attempt to carry the resolution over the veto failed.

MINNEAPOLIS, MINN.—The Board of Directors of the Twin City Telephone Company have declared a quarterly dividend at the rate of 7 per cent per annum, payable November 1.

JEFFERSON CITY, MO.—The Jefferson City Telephone Company has been bought by Lester A. Parker, H. McHenry and A. M. Hough. The exchange was formerly owned by the Capitol Telephone Company.

ULYSSES, NEB.—The Ulysses Independent Telephone Company has been incorporated, with a capital of $5,000.

LINCOLN, NEB.—The Waco Telephone Company has been organized with a capital stock of $25,000. It is proposed to establish a telephone system with headquarters in Waco. J. A. Gilbert and twenty-four others are incorporators.

PERTH AMBOY, N. J.—The Hudson & Middlesex Telephone Company has been granted a franchise here.

AURORA, N. Y.—The Empire Telephone Company is constructing a line from this place to Cayuga.

ELMIRA, N. Y.—The Elmira Telephone Company has been consolidated with the York State Telephone Company which controls exchanges in Cortland, Binghamton, Glen Falls and other cities.

GASTONIA, N. C.—A new telephone company has been chartered at Gastonia by N. B. Kendrick and other stockholders. The capital stock will be $11,000.

LINCOLNTON, N. C.—The Bell Company has purchased the plant and exchange of the Lincoln Telephone Company, of Lincolnton. A number of private lines were cut out and Dr. Hunter of Stanley Creek, N. C., has been granted the right to put in an exchange in Lincolnton.

OAKES, N. D.—The Dakota Central Telephone Company, of Aberdeen, has purchased the Oakes telephone exchange and will operate it in connection with the entire system. Extensive improvements will be made.

ARCHBOLD, OHIO.—The Archbold Telephone Company has increased its capital stock from $10,000 to $20,000.

DELAWARE, OHIO.—The Citizens' Telephone Company is installing a new modern board of 1,800 lines capacity. About 1,000 will be installed at the start.

YOUNGSTOWN, OHIO.—The United States Telephone Company has established a long-distance switching station at Youngstown. Five operators will be employed at this point.

SANDUSKY, OHIO.—The Green Spring Telephone & Electric Company, of Seneca and Sandusky counties, has increased its capital stock from $15,000 to $25,000. J. C. Kanney is president.

SANDUSKY, OHIO.—The deal for the sale of the Sandusky Telephone Company to the Laning syndicate, of Norwalk, has been effected. The company will be known as the Sandusky Local Telephone Company.

PORTSMOUTH, OHIO.—The Central Union Telephone Company is installing free telephones in Portsmouth. No charge is to be made until 800 telephones are in use. There is a strong independent company in the field.

DELAWARE, OHIO.—F. M. Marriott, of the Harrison Construction Company, has organized a company with $300,000 capital stock at Pueblo, Colo., and expects to establish telephone exchanges in that place as well as at Colorado Springs. The company is also planning to build a long distance line to Salt Lake City.

ZANESVILLE, OHIO.—The Zanesville Telephone & Telegraph Company will enlarge its system. About $50,000 will be expended for the purpose. Solicitors will be put to work to regain the subscriptions which the company was compelled to cancel on account of insufficient capital at the time of the Everett-Moore trouble.

YOUNGSTOWN, OHIO.—The Beaver Telephone Company has commenced operations. Its system extends over the whole of Beaver township. The company is negotiating with the Central Union Telephone Company and the Youngstown Telephone Company for long distance service. Officers of the new company are: W. H. Ruhlman, president; C. Culp, vice-president; R. B. Metzler, treasurer; John Yoder, secretary, and S. B. Culp, manager.

PITTSBURG, PA.—The Central District and Printing Telegraph Company has declared its regular dividend of 2 per cent, payable October 31.

DYERSBURG, TENN.—The West Tennessee Telephone Company has incorporated to establish a telephone system. W. C. Paris is manager.

CENTER, TEX.—The Sabine Valley Telephone Company, capital stock $20,000, has been incorporated by E. C. Branch, W. A. King, James T. Polly and J. W. Sanders.

ROANOKE, VA.—The West Virginia Eastern Telephone Company will extend its lines from Century to Buckingham.

PETERSBURG, VA.—The recent consolidation of telephone interests in Petersburg places the Bell Company in entire control in that city. It is said that rates will be increased.

PARKERSBURG, W. VA.—The general offices of the Consolidated Telephone Company have been removed to Fairmount. General Manager Funkhauser has resigned and has been succeeded by C. W. Evans, of Fairmount.

ELECTRIC LIGHT AND POWER.

BIRMINGHAM, ALA.—The Birmingham Railway, Light and Power Company has applied to the City Council for a franchise to operate a steam heating plant in conjunction with its electric lighting and street car system. The company expects to spend over a quarter of a million dollars in the new plant.

SAN FRANCISCO, CALIF.—The South Yuba Water Company's great system of water ditches and three small electric power plants are to be purchased by an Eastern syndicate headed by C. N. Felton. It is said that the purchase price, over $3,000,000, will be paid over as soon as the expert engineers complete their reports on the properties. The two electric plants at Auburn and Newcastle are operated by the Central California Electric Company and supply current for Sacramento, while the newly-installed plant at Altaville will supply Grass Valley, Nevada City, Marysville and other places.

SAN FRANCISCO, CALIF.—Water rights on the Tuolumne River near Jacksonville, Tuolumne County, Calif., have been secured by G. A. Wilbur & Co. It is estimated that from 4,000 to 10,000-hp can be developed. About ten miles of ditch and flume will be required to obtain the best results. It is proposed to transmit electric power a distance of nearly fifteen miles to Jamestown for mining purposes as well as lighting. Sidney Sprout, the electrical engineer for the enterprise, has gone to Jacksonville to ascertain the minimum flow of water. He will complete the preliminary work and a good deal of construction work can be accomplished this winter.

DENVER, COLO.—The Boulder Creek Mining and Power Company, which owns extensive properties in Boulder Creek, Colo., mining district, has been organized in Bay City, Mich., with a capital of $2,000,000. W. C. Penoyer, of Bay City, is president of the company. The company has secured from the United States and from Colorado the riparian rights in Boulder Creek, Colo., for power purposes and will soon build a plant of 10,000-hp. The company will convert the old Coburn mill six miles above Boulder into a cyanide plant of 100 tons capacity per day. The Coburn mill, where the electric plant is also to be erected, is three and a half miles above where the city of Boulder secures its water for town purposes.

BOISE, IDAHO.—The electric light and gas company of Boise is installing a 2,700-hp electric power plant on the Payette river, 20 miles above Boise, and the plant will be completed about Dec. 1. It will cost when completed about $400,000. It is the intention of the company to light Boise and to furnish power for a number of mines in the locality. Later on the business of the company will be extended to other towns where light and power is needed.

QUINCY, ILL.—The smokestacks of the local electric light company were blown down in a tornado recently, and the city was put in temporary darkness.

FORT WAYNE, IND.—The Pennsylvania Company has approved plans for the erection of a large electric lighting plant at Conway, near here. The building and equipment will cost approximately $50,000 and is the first of several to be erected at important points on the system west of Pittsburg. Recently the officials of the company decided to equip all important yards with electric lights in order to permit the men to work by night as well as day.

MARKSVILLE, LA.—The Marksville Electric Light and Power Company, Limited, has been chartered. The contract for building and fixtures was awarded to Lyman C. Reed, of New Orleans. The officers of the Board of Directors are: Dr. Walter F. Couvillion, president; A. V. Saucier, vice-president; T. T. Fields, secretary, and L. J. Coco, treasurer.

BOSTON, MASS.—The Gas and Electric Light Commissioners have approved the petition of the Attleboro Steam & Electric Company for permission to issue $40,000 stock.

EASTHAMPTON, MASS.—The Hampton Company is installing an electric power and lighting equipment and the plant is to be electrically driven. Two polyphase generators, one direct-connected to a Corliss engine and the other belted to a water wheel will supply the current. The machines will be interchangeable, so that either one or both may be used as desired for power or lighting.

PORT HURON, MICH.—At the coming election a proposition to issue $50,000 worth of bonds for electric lighting purposes will be submitted to a vote.

DULUTH, MINN.—The capacity of the Duluth General Electric Company's plant will be doubled by the installation of a 2,500-hp engine. At a cost of $250,000 the company has changed its plant throughout, introducing a large amount of new machinery.

PRINCETON, N. J.—The University Power Company, of Princeton, has been incorporated to supply electric light power; capital, $25,000. Incorporators: Robert H. McCarter, Edwin B. Williamson and Conover English.

SAUGERTIES, N. Y.—The Saugerties Light, Heat and Power Company, of Saugerties, has been incorporated; capital, $50,000. Directors: H. B. Hord and R. C. McCormick, New York; C. W. Eichells, Jr., Ridgewood, N. Y.

MEDINA, N. Y.—The Medina Foundry Company is erecting a new plant to operate by electric power and has purchased six induction motors from the General Electric Company. The officers are: Michael Slack, president; Orren F. Butts, vice-president and general manager, and B. Edward Slack, secretary and treasurer.

WINSTON, N. C.—The Winston-Salem, N. C., Gas and Lighting Company has recently re-organized, New York and Philadelphia capitalists having secured a controlling interest in the plant. Dr. W. H. Reynolds and B. G. McAdoo, of New York, are interested.

CLEVELAND, OHIO.—Bishop & Babcock, manufacturers of tanks, etc., have completed plans for the erection of a large brick power house on Hamilton Street. They propose to operate nearly all of their machinery by electric motors.

MURFREESBORO, TENN.—Dynamos, engines, etc., will be purchased by the City Gas & Electric Company, which has had plans prepared for improvements to cost about $15,000.

SALT LAKE CITY, UTAH.—Over $100,000 worth of new mining machinery has been received at the various claims in the Buffalo Hump, Idaho, country within the past ninety days, and includes electrical equipment to the value of nearly half the cost of the entire outfit.

NEW MARTINSVILLE, W. VA.—The New Martinsville Electric Light, Heat and Power Company and the New Martinsville-Sistersville Electric Railway Company both have applications for franchises pending.

CITY OF MEXICO, MEX.—The municipal council of the City of Mexico has authorized the Compania Mexicana de Gas y Luz Electrica to place its cables underground where necessary for city service. The cables must be laid under the sidewalks.

MONTEREY, MEX.—The electric light plant of the Monterey Electric Light and Power Company is to be increased in capacity from 800-hp to 2,000-hp. Emilie Dysterud, general manager of the company, has been making an extended tour of the north and east inspecting the electric light plants of the principal cities of the United States.

SAN LUIS POTOSI, MEX.—The city council of San Luis Potosi has granted a franchise to George Waddill, representing an American company, to install a new electric light and power plant in this city. The company has a capital stock of $300,000 and has already begun the work of constructing the new plant.

THE ELECTRIC RAILWAY.

WILMINGTON, DEL.—The Delaware Suburban Railway Company has been incorporated at Dover, with a capital stock of $100,000. The company proposes to construct a road connecting with that of the Wilmington City Railway's extension at Stanton. The road will extend from there to Chesapeake City.

FAIRBURN, GA.—Citizens of Fairburn, nineteen miles from Atlanta, are agitating the question of having the electric railways of Atlanta extended to Fairburn.

MUNCIE, IND.—The Union Traction Company has been granted a franchise to extend its system from this city to Alexandria.

DALEVILLE, IND.—The Union Traction Company has been granted a franchise to extend its system from Daleville to Middletown.

WABASH, IND.—The Wabash-Logansport Traction Company, operating the Peru interurban road, has accepted a franchise and is under bond to build a city system in Wabash.

ALEXANDRIA, IND.—The New Hartford City-Alexandria Electric Company has accepted the terms of the franchise ordinance passed by the Alexandria Council, and work will begin at this point also.

KOKOMO, IND.—The Indianapolis & Northern Traction Company, in addition to receiving a franchise to enter this city, has been granted a franchise for an electric lighting and heating plant in this city.

JEFFERSONVILLE, IND.—The Southern Indiana Railway Company, of Jeffersonville and New Albany, has filed articles of incorporation with the Secretary of State. The capital stock is $300,000. The directors are N. A. Street, C. R. Taylor, N. I. Keefe and M. E. Callender.

INDIANAPOLIS, IND.—The New Albany, Paoli & French Lick Valley Traction Company has filed articles of incorporation; capital stock, $100,000. The incorporators are: Thomas Taggart, Crawford Fairbanks, L. F. Dickson, of Chicago; B. J. T. Jeup, of Indianapolis, and Thomas B. Buskirk, of Paoli.

EVANSVILLE, IND.—The board of directors of the Evansville & Princeton Traction Company has let the contract for the building of the power house to a New York firm. The power house is to be located at Fort Branch, half way between this city and Princeton, and will cost $72,000. The Evansville & Princeton Traction line will be in operation by April 1. Several other electric lines are being planned out of Evansville.

EVANSVILLE, IND.—The Evansville, Boonville & Rockport Railway Company has filed articles of incorporation. The road will run from Evansville through Vanderburg County to Newburg and Boonville in Warrick County and to Rockport in Spencer County. The company proposes to purchase and lease street railway systems to connect with and complete its interurban system. William Freekeld, Chas. E. Maley and E. C. Henining are the directors.

NEW ORLEANS, LA.—The Myles Salt Company intends to build an electric railway from New Iberia, La., to Berwick City, a distance of 54 miles.

NEW ORLEANS, LA.—The strike of the street railway employees was settled on the 13th inst., after a duration of 15 days. The basis of settlement is that the men shall receive 20 cents an hour, a day's work to consist of ten hours.

AUGUSTA, ME.—The Auburn, Mechanics Falls & Norway Street Railway Company has petitioned the Railroad Commissioners for articles of association. F. H. Wilson, of Brunswick; E. B. Hart, Jr., of New York; A. H. Shaw, S. R. Percy and F. E. Southard, of Bath, are the directors. The company proposes to build an electric railway from Auburn to Norway, a distance of 24 miles. The capital stock is $100,000.

WORCESTER, MASS.—The Worcester Consolidated Street Railway Company has declared a dividend of 3 per cent.

WESTFIELD, MASS.—At the annual meeting of the Westfield Electric Railway Association the following named gentlemen were elected officers: President, A. D. Stanton, of Huntington; clerk and treasurer, J. H. Dickinson. It is expected that construction work on the road will be started next spring.

SPRINGFIELD, MASS.—At the annual meeting of the Greenfield & Turners Falls Street Railway Company provisions were made for extending the road from Four Corners to Federal Street, making a loop. The bonded indebtedness is to be increased not to exceed $130,000. These officers were elected: President, Maj. F. E. Pierce; clerk and treasurer, D. P. Abercrombie, Jr.; superintendent, J. A. Taggart; engineer, C. W. Clapp; auditor, Jone E. Donovan; trustees, Maj. Pierce, D. P. Abercrombie, Jr., J. A. Taggart, C. W. Clapp, J. W. Stevens, D. P. Abercrombie, Sr., N. S. Cutler, Isaac Chenery, Albert T. Hall, Springfield, Mass.

CONCORD, N. H.—The long-talked-of railway between Concord, Dover and Rochester will be constructed. A contract for 4,000 tons of 70-pound steel rails was executed recently between the Pennsylvania Steel Company and the Rochester Street Railway Company.

TRENTON, N. J.—The Whippany & Passaic River Railroad Company, capital $375,000, has been incorporated here to build a railroad seven miles long from Whippany to Essex Falls, N. J. The incorporators are: Edward M. Shepard, Brooklyn; Herman Behr, Robert D. Foote, W. W. Cutler, Morristown; Richard W. McEwan, Robert B. McEwan, Jesse L. McEwan, Whippany, N. J.

AMSTERDAM, N. Y.—The Fonda, Johnstown & Gloversville Railroad Company has increased the wages of the motormen from 16½ to 18 cents an hour. Motormen who have been in the employ of the company for less than a year receive an increase of from 15 to 16½ cents an hour. The increase in wages was not asked for.

ALBANY, N. Y.—The Lake Erie Traction Company has obtained consent from the State Railroad Commission to issue a first mortgage for $400,000 and to increase its capital stock from $126,000 to $500,000. The proceeds from the sale of the additional securities are for the construction and equipment of the road from Westfield, Chautauqua County, to the Pennsylvania state line.

ALBANY, N. Y.—The Bull's Head & Annadale Beach Railway Company has filed articles of incorporation. The capital stock is $250,000. The company will build a line 8 miles long in Richmond Borough, New York, from Bull's Head to Annadale Beach. The directors are: James W. Hughes, Harcourt Bull, J. M. Israel, C. W. Kappes, A. E. Haskins, H. S. Weed, J. L. Doyle, W. H. Cressman, of New York, and David Murphy, of Jersey City.

BROOKLYN, N. Y.—The Brooklyn Rapid Transit Company, Brooklyn Borough, has purchased for $30,000 the property of Christ Protestant Episcopal Church, at Third Avenue and Sixty-eighth Street, Brooklyn. The edifice is to be removed to make way for the construction of an inclined plane to connect the elevated railroad structure with the surface line on Third Avenue. The company plans to operate trains over the elevated road through to Fort Hamilton.

STATEN ISLAND, N. Y.—The Staten Island Rapid Transit system has established an entrance into Plainfield, N. J., over the New Jersey Central's tracks, and a schedule goes into effect which insures connection between trains from St. George, S. I., and Philadelphia, Baltimore, and Washington. Regular Staten Island expresses will make Plainfield a terminal, and the Royal Blue Line, of the Baltimore and Ohio, will stop there. East and west bound schedules have been arranged.

PORTSMOUTH, OHIO.—The Ohio Valley Traction Company has amended its charter to enable it to extend its line to Ironton.

COLUMBUS, OHIO.—The Columbus, Delaware & Marion Railway has opened through service from North Columbus to Delaware.

MASSILLON, OHIO.—The Canton-Akron Railway Company has purchased a right of way from Massillon to East Greenville, and is planning a spur line to that town.

DAYTON, OHIO.—Officials of the Dayton & Northern Traction Company are closing contracts for the extension of the line from Greenville to Union City and into Indiana.

CINCINNATI, OHIO.—The directors of the Cincinnati, Newport & Covington Light & Traction Company have declared a quarterly dividend of one per cent. on the preferred stock.

CLEVELAND, OHIO.—W. J. Prentz is in this city endeavoring to interest capital in building an electric railway from Mansfield to Ashland over which route he claims to have secured right of way.

CINCINNATI, OHIO.—The Cincinnati, Milford & Loveland Traction Company has been incorporated with $700,000 capital stock by J. M. Wilson, Claude Ashbrook, J. N. Roberts, B. H. Kroger and others of Cincinnati.

MANSFIELD, OHIO.—The Mansfield, Mt. Gilead & Delaware Traction Company has secured a franchise in Mansfield, and grading is to start at once. The road will be the connecting link between Columbus and Cleveland.

TOLEDO, OHIO.—The Toledo, Columbus, Springfield & Cincinnati Railway Company claims to have arranged for the sale of $925,000 worth of bonds. A site has been secured at Roundhead for a large power house.

SPRINGFIELD, OHIO.—The stockholders of the Dayton, Springfield & Urbana Electric Railway have decided to increase its capital to $1,500,000 for the purpose of double-tracking and making other important improvements.

ASHTABULA, OHIO.—The Pittsburg, Lisbon & Western Railroad Company has been incorporated with a nominal capital of $10,000 by R. W. Taylor and others. The company proposes to "operate a steam or electric road from Ashtabula Harbor to Steubenville."

SPRINGFIELD, OHIO.—Directors of the Urbana, Bellefontaine & Northern Traction Company will meet October 30 to vote on increasing the capital stock to $500,000 and to complete traffic arrangements with the Dayton, Springfield & Urbana Railway. Both roads are controlled by the same interests.

CLEVELAND, OHIO.—The Ohio & Pennsylvania Traction Company has been incorporated by F. B. Krause, Charles L. Gilbert, C. C. Daugherty, L. A. Calkins and others. Temporary capital stock $10,000. The company proposes to build a direct line from Cleveland to Sharon, Pa., by way of Warren.

TOLEDO, OHIO.—J. M. Mulkey, of the Black-Mulkey syndicate, owners of the Toledo & Monroe Railway, states that negotiations with the Detroit United Railway relative to the sale of the property, have been declared off and that his people will proceed at once with the work of extending the line to Detroit.

ZANESVILLE, OHIO.—Col. A. E. Boone, who has secured franchises for several electric roads to radiate from this city, is endeavoring to secure capital to build the first line, charter for which has been taken out under the name of the Zanesville & Southeastern Ohio Railway Company, with a capital of $10,000.

TOLEDO, OHIO.—The Toledo, Bowling Green & Southern Traction Company is arranging to handle freight business on the same basis as the other interurban lines entering Toledo. The matter has been held up on account of insufficient power, but this difficulty will be remedied by the speedy completion of a new station at Cygnet.

DAYTON, OHIO.—It is reported that the Pomeroy-Mandelbaum syndicate is planning to erect in this city one of the largest power plants in the country, to be used in the operation of both the Cincinnati, Dayton & Toledo Traction Company and the Miami & Erie Canal. The officials in Cleveland are not prepared to verify the statement.

CHILLICOTHE, OHIO.—The smokestack on the new power house of the Chillicothe Street Railway, Light & Power Company collapsed a few days ago entailing a loss of between $6,000 and $10,000. The stack was 175 feet high. It is believed the accident was caused by the base being too small and not having a sufficiently solid foundation.

ZANESVILLE, OHIO.—The Zanesville Railway, Light & Power Company has been incorporated by George H. Warrington, John Ross, George M. Finch, E. F. Gunther and Thomas Braxton, Jr. Capital stock is $1,000,000. It is stated the new company has succeeded the Zanesville Street Railway and that the deal involves the construction of interurban roads from Zanesville.

CINCINNATI, OHIO.—Through the consolidation of various traction roads it is proposed to operate a line between Cincinnati and Springfield, Ohio. The Springfield & Xenia Company and the Scrugham lines will figure in the combination. Local interests prominently identified with the Elgin, Aurora & Southern Traction Co. have been given the assurance that these two properties will soon consolidate.

CINCINNATI, OHIO.—At the annual meeting of the Cincinnati, Georgetown & Portsmouth Railway the former officers were re-elected, as follows: A. W. Comstock, president; W. R. Todd, vice-president; R. E. Field, secretary-treasurer; E. W. White, general manager, general freight and passenger agent, and P. T. Dunn, superintendent. The work of converting this line into an electric system is progressing rapidly and cars will soon be in operation to Georgetown. The power house at Olive Branch is about completed.

CLEVELAND, OHIO.—It is announced that the deal for the sale by the Everett-Moore syndicate to the Grand Trunk Railway (steam) of the Detroit & Toledo Shore Line has been finally consummated, the price being about $1,600,000. It is now probable that the Everett-Moore syndicate will redouble its efforts to buy back the Toledo & Monroe Railway in order that the connection of the Ohio and Michigan systems may not be broken. The closing of this deal removes the last of the Everett-Moore difficulties so far as traction properties are concerned. The option held by Claude Ashbrooke, of Cincinnati, on the London (Ont.) Street Railway interests has expired and it will not be renewed. The syndicate will probably retain this property.

POTTSTOWN, PA.—The Pottstown & Reading Electric Railway Company has applied for a charter. J. C. Bricker, Dr. S. C. Dolley, J. D. S. Barham and F. F. McCall are the applicants. With the building of a line to Reading from Pottstown there would be a complete trolley system between the former city and Philadelphia.

NASHVILLE TENN.—The Nashville Railway Company announces that it will expend $1,000,000 in improving its system.

CLEVELAND, TENN.—An application has been made for a charter for an electric railway to run from Cleveland to Ducktown, Tenn. The cost is estimated at $400,000.

CLARKSVILLE, TENN.—Local and outside capitalists have begun securing right of way for two electric railways from Clarksville, one running to Nashville and the other running to Guthrie, Ky. T. N. Watson is interested in the former and H. N. Leech, attorney, has been granted right of way for the second road.

TACOMA, WASH.—The Hoquiam & Aberdeen Street Railway Company has issued $125,000 in bonds to be sold in the East, the proceeds of which are to be used in building an electric railway between the two principal towns on Greys Harbor.

WHEELING, W. VA.—It is announced that a four-months option has been given on the majority of the capital stock of the Wheeling Traction Company to T. H. Conderman, president of the company. The company is capitalized at $4,500,000. The property includes the majority of the city lines in Wheeling, the Steubenville, Mingo & Ohio Valley Traction Company, the Bridgeport, Bellaire & Martin's Ferry Railway and several lines under construction.

LEGAL.

RECEIVER FOR THE ALBANY & HUDSON ROAD.—Mr. Geo. T. Blakeslee, of Kinderhook, N. Y., has been appointed receiver for the Albany & Hudson Railway Company. The officers state that the appointment of the receiver is the first step in a plan for a complete reorganization of the company. The system will continue in operation.

WIRELESS LITIGATION.—The suit of the De Forest Wireless Telegraph Company against the Marconi Wireless Telegraph Company of America, E. Rollins Morse, Henry R. Shaw, Robert W. Emmons, second, and George W. Parker, of the firm of E. Rollins Morse & Bro., to recover $1,000,000, which was begun in the Supreme Court of New York State, has been transferred to the United States Circuit Court. The petition for the transfer was made on the allegation that the De Forest Company is a citizen of Maine, the Marconi Company a citizen of New Jersey and that all the members of the firm of E. Rollins Morse & Bro. are citizens of the State of Massachusetts. They offer a bond of $100. Betts, Sheffield & Betts are attorneys for the Marconi Company, and Knabe & Butler are attorneys for the De Forest Company.

RAILROAD SECRETS INVIOLATE.—At Albany, N. Y., on October 18, Justice Alden Chester handed down an important decision affecting the organization of railroad companies. The State Board of Railroad Commissioners has refused, in the case of the organization of such corporations, to make public information submitted with applications to construct and operate their proposed roads or to make public the source of financial support upon which the companies relied to carry their prospects into execution. Justice Chester, in the case of the Portchester Railroad Company, has decided that the Board has the right to keep such information confidential, denying an application made by the New York, New Haven & Hartford Railroad in this case for an order to compel the State Board to make public this information.

PERSONAL.

MR. H. O. SWOBODA has resigned his office as secretary and treasurer of the Falcon Electric Manufacturing Company of New York City.

MR. H. W. HOBBS, who has been the active man in the Hawks Electric Co., has retired from that Boston firm. After a thorough rest, he will probably enter the engineering field.

DR. F. HABER is to lecture before the Society of Chemical Industry, New York section, on "Ferrous and Ferric Acids," with experiments, on October 24, at the Chemists' Club.

MR. HUGH A. BROWN, for two months past in the Chicago office of the Crocker-Wheeler Company, has moved to the Cleveland office of that company, where he will give special attention to the electrical equipment of machine shops.

PROF. KAMMERER, in a recent address before the German Engineers' Society, at Dusseldorf, spoke highly of the modern electric telpherage system as developed in Europe, and expressd his belief that it would come into general adoption there.

MOORE-SKITT.—At Yonkers, N. Y., on October 15, Miss Edith Skitt, daughter of Mr. Alfred Skitt, the well-known Manhattan Elevated manager, was married to Mr. Edwin Webb Moore in Grace Chapel. Among those present were Mr. and Mrs. George Gould and Mr. E. V. W. Rossiter.

MR. GEORGE E. WATTS, who for some five years past has represented the Columbia Incandescent Lamp Company as sales agent for St. Louis, Kansas City, Omaha and other Western cities, has established himself in the Chemical Building, St. Louis, as a manufacturers' agent, on his own responsibility.

PROF. A. G. BELL,—The degree of Doctor of Laws will be conferred on Prof. Alexander Graham Bell, of Washington, and Henry White, Secretary of the United States Embassy, in addition to Ambassadors White and Choate, this week, by St. Andrew's University, where Andrew Carnegie is to be reinstalled as Rector.

MR. D. CLARENCE DURLAND, who is well known in the electrical field, has been elected second vice-president of the Sprague Electric Company. For the

past three years he has been assistant manager of the Sprague Company, and his promotion is evidence of his engineering and executive abilities, which he has combined to a marked degree.

MR. FRANK D. MOSES, chief engineer of the South Jersey Gas, Electric and Traction Company, has resigned. Mr. Richard Stockton, assistant to President A. R. Kuser, has also resigned.

MR. E. W. BATCHELLAR, formerly purchasing agent for the Denver (Colo.) Gas and Electric Company, has been appointed general manager of the San Antonio (Tex.) Gas and Electric Company and the San Antonio Traction Company.

MR. FRED W. PARKE, of the Westinghouse Air Brake Works, St. Petersburg, Russia; M. Schatelowitz, V. Chogiokoff and Irvin Prokhanoff, of the same concern, are now in the United States for the purpose of inspecting various electric plants. At present these gentlemen are in Pittsburg.

COL. ALLAN C. BAKEWELL, who was recently elected president of the Sprague Electric Company, has long been identified with the electrical industry, and has won many friends through his executive ability and honorable business methods. He was vice-president and general manager of the old Interior Conduit and Insulation Company, which was absorbed by the Sprague Electric Company some years ago. Previous to his present office he was for three years second vice-president and general manager of the Sprague Company.

Trade Notes.

THE ELECTRIC STORAGE BATTERY COMPANY has qualified to do business in Ohio. Its Ohio office is in the New England Building, Cleveland.

THE PHELPS COMPANY, makers of the "Hylo" incandescent lamps, Detroit, Mich, has opened an office in the Monadnock Building, Chicago, in charge of Mr. J. Wiley Phelps, and a San Francisco office at 220 Sutter Street, with Mr. Joseph Thieben as representative.

OIL TRANSFORMERS.—The Ft. Wayne Electric Company, in a neat folder, describes and illustrates the Type A oil transformers, which are made in standard capacities from .6 to 50-kw for primary voltages of 1,000 to 2,000 and secondary voltages of 50 or 100 and 100 or 200.

WOOD MEASURING INSTRUMENTS.—The Ft. Wayne Electric Works, Ft. Wayne, Ind., have issued a pamphlet entitled "Instruction Book for Wood Measuring Instruments." Instructions are given for the location, insulation, connecting-up, etc., of the several types of Wood voltmeters and ammeters, including an ammeter for arc circuits.

WESTINGHOUSE AIR BRAKE COMPANY, Pittsburg, has sent us a copy of the folder issued for the Detroit Street Railway Convention by the Standard Traction Brake Company, and devoted to the exhibition of apparatus in the Light Guard Armory, where a very fine display in regard to the Newell magnetic track brake system was made.

THE CROCKER-WHEELER COMPANY, Ampere, N. J., has been distributing a souvenir in the shape of a sterling silver match box in the centre of which on a celluloid background appears the name and address and trade mark of the company. The marked utility of this souvenir ensures a pleasing remembrance constantly recurring of the curtesy of the company.

THE FISHER ELECTRIC COMPANY, of Toledo Ohio, has been incorporated, with $10,000 capital stock. The company succeeds the Fisher Electric Construction Company, and will do a retail and general construction business. The incorporators are: J. M. Shunck, H. B. Thompson, Emil X. Schaefer and Hugh Shunck. The company has leased warerooms at 114 St. Clair Street, that city.

PROMPT SHIPMENTS. "Goods received and thanks for your prompt shipment."—The above is a sample extract from many similar letters received by the Electric Appliance Company, Chicago. This would not be extraordinary in ordinary times but in this busy year and season, they speak volumes for the system and hustle to expedite deliveries in vogue at the Appliance Company's shipping department.

PORTABLE FORGES.—The Buffalo Forge Company, Buffalo, N. Y., has issued an interesting pamphlet illustrating and describing the principal features of construction and the advantages of its portable forges, blowers, blacksmith tools, punches, shears, bar cutters, tire benders and upsetters. The illustrations of these various devices are very clear, and the accompanying tables give the various dimensions of the machines, together wth price lists.

ELECTRIC HEATING.—The American Electric Heater Company, Detroit, Mich., has issued a new catalogue (No. 18) descriptive of the wide range of electric heating apparatus of its manufacture. The extent of this line can be surmised from the fact that eight different forms of curling-iron heaters are shown. Full lines are illustrated of soldering, laundry, and other irons, no less than 16 types of laundry and pressing irons being shown.

FAN MOTORS.—Bulletin No. 68, of the Massachusetts Fan Company, Waltham, Mass., relates to the Davidson electric propeller fans of a type applicable for all sorts of ventilating practice, as in public buildings and houses, for the removal of hot and moist air, for ventilating and drying, and for the circulation of hot and cold air for the purpose of heating or cooling. The motors are wound for 115, 230 and 500 volts, their loadings being from ¼ to 7½ horse-power.

THE NATIONAL X-RAY REFLECTOR COMPANY, 107 Dearborn Street, Chicago, reports an extensive demand for its various lines of mirror reflectors and fixtures. It has in consequence opened a New York branch at 26 Cortlandt Street, where it will carry a full stock in order to make immediate deliveries to contractors, supply dealers and the trade generally. Its reflectors are giving satisfaction wherever used, and this new departure in opening a branch in the East will be a great convenience to its customers.

ROYAL ALTERNATORS AND TRANSFORMERS.—The Royal Electric Company, Peoria, Ill., has issued a revised edition of its bulletin illustrating and describing the Royal alternating-current generator; and also a pamphlet descriptive of the Royal transformer. The Royal generator, as is well known, is of the inductor type, and the bulletin illustrates all of its features in detail. The Royal transformer is claimed to have decided advantages over the core type, which latter is stated to sacrifice efficiency to cheapness in construction and convenience for repair.

ELECTRIC LOCOMOTIVES FOR SURFACE HAULAGE.—With this title the Baldwin Locomotive Works and the Westinghouse Electric and Manufacturing Company have issued a handsome 78-page catalogue illustrating and describing a number of standard types of electric locomotives for electric haulage. About a score of the illustrations show locomotives at work which have been supplied to various concerns throughout the United States and in foreign countries. The latter part of the catalogue illustrates in detail every part of the electrical equipment, such as the controller, equipment, etc.

LINOTAPE.—To meet the demands of the trade the Mica Insulator Company, of New York and Chicago, has commenced the manufacture of a new process oil cloth in the form of tape, under the registered name of "Linotape." The foundation of the tape is a closely woven special cloth, and the coating consists of a film of "Empire" oil on both surfaces. It is claimed that the coating never cracks nor hardens, and it renders the cloth proof against acids and alkali. In some comparative tests, "Linotape" showed an insulation of 881 megohms as against 9.6 megohms for the ordinary friction tape; and a puncturing voltage of 2214 as against 1800 for the friction tape.

VULCABESTON PACKING.—The H. W. Johns Company has issued a catalogue devoted entirely to the subject of vulcabeston packing. As an illustration of the superiority of vulcabeston steam packing, the incident is cited of the drilling engine in the yards of the Westinghouse Air Brake Company, which ran for ten months with one packing of vulcabeston; before using this packing, it was necessary to repack the pump as often as once in three weeks. It is stated that this packing is adapted to any steam pressure, does not deteriorate through the action of high pressure or superheated steam, will not harden, crack or char, is pliable and easily cut, and has no expansion or contraction. With its use joints can be easily broken and repacked, a tight joint may be made on rough flanges, and it is not necessary to turn on steam to set the packing.

ENGLISH NERNST LAMP.—The Nernst Electric Lamp Company, Ltd., 82 Victoria St., London, England, sends a catalogue in which the English form of the Nernst lamp is well illustrated and described in detail. The English form of the lamp is quite different from the American, the glower being in the form of a spiral filament, which in some lamps is disposed vertically and in others horizontally. The curve of distribution of the light shows almost an equal distribution above and below the horizontal. The lamp is made in capacities from 15 to 150-cp., the consumption of current being from 1.75 to 2 watts per candle. The average life of the lamp is given as about 400 hours. The price of model A, or lamp of larger candle power, is given at $4.50, and the price of replacement pieces at 50 cents or 62 cents; the price of model B, or lamp of smaller candle power is $1.25, and the price of replacement pieces 37 cents.

HOLOPHANE GLASS COMPANY, 15 East Thirty-second St., New York, has just issued a very handsome and useful catalogue devoted to its celebrated "Holophone Globes." It is both curious and encouraging to note how this specialty has won its way into popularity on strict merit. No one who uses a holophane globe ever after disputes its utility or allows any one else to decry its value. The pamphlet discusses clearly and briefly the main lines of the argument in favor of the principle adopted and the methods of manufacture employed to secure a complete diffusion of light, without glare or glitter or abnormal points of dazzle. The various types of ribbed glass are noted and a large number are illustrated, together with the sizes, details of application, etc. The cover is a quaint and dainty piece of work. The company has commenced the publication of a periodical called *The Holophane News*, which will be issued monthly or as occasion may require.

FT. WAYNE BULLETINS.—The latest Ft. Wayne Bulletins are three in number and have for their respective subjects "Enclosed Direct-Current Power Circuit Arc Lamps," "Enclosed Direct-Current 110 volt Arc Lamps," and "Standard Small Motor Panels." The power circuit arc lamps are of the multiple series type for use with either two or five in series on 220 or 500 volt circuits. In all cases the voltage at the arc is 75 to 80 volts, and the average life of a carbon 150 hours for a current of 5 amperes. The enclosed direct-current arc lamp for 110-volt circuits can be adjusted to operate satisfactorily for any current from 4.5 to 6 amperes, the normal life of a set of solid carbons being 150 hours when the lamp is adjusted for a current of 5 amperes. The standard small motor panels are in capacities of ¼ to 30-hp for 115, 230 and 500-volt circuits. The compactness and neat appearance of these panels are evident from the illustrations given of the same.

CARRIAGE BUILDERS EXHIBITIONS.—A fine display of apparatus was made at the convention of the National Carriage Builders' Association at Detroit, by the Westinghouse Electric & Mfg. Co., of Pittsburg, and at the Philadelphia convention of the American Carriage Builders' Association, from September 13 to 18. The exhibit showed the electric equipment made by the Westinghouse Company for use on motor vehicles and it included an Adams Express Company wagon that has been in use for seven months and is fitted with the Westinghouse double motor equipment. Another had a complete double motor equipment assembled on the frame of an express wagon of moderate size. There was also shown the skeleton frame of a standard surrey, equipped with a complete 80-volt, high-speed, plain bearing, double motor equipment. The exhibit embraced also five detached motors designed to meet the severe conditions under which the electric motor is operated and capable of sustaining for one hour a load of 100 per cent. above the normal rating, and to commutate perfectly up to an overload of 200 per cent. The frames are tubular specially designed for universal methods of suspension and to facilitate removal, inspection and repair. These motors are of 40 and 80-volt capacity, high and low speed, to meet the different requirements of passenger and merchandise transportation, up to 11,000 pounds at six miles an hour.

Record of Electrical Patents.

UNITED STATES PATENTS ISSUED OCTOBER, 14, 1902.

[Conducted by Wm. A. Rosenbaum, Patent Attorney, 140 Nassau St., New York.]

710,938. VOLTMETER SCALE; W. C. Baker, Cleveland, Ohio. App. filed Feb. 15, 1902. The scale not only shows the total voltage of the battery, but also the voltage per cell.

710,943. ELECTRODE FOR ARC-LAMPS; H. Bremer, Neheim, Germany. App. filed March 3, 1900. (See Current News and Notes.)

710,946. ELECTRIC BELL; C. L. Burlingham, Chicago, Ill. App. filed Nov. 2, 1901. Details.

710,953. ELECTRIC BATTERY; A. J. Cook, Jersey City, N. J. App. filed July 20, 1901. The bottom of the jar is formed with ridges over which grooves in the elements of the battery, rest, to prevent the latter from moving.

710,990. DEVICE FOR LOCATING BREAKS AND GROUNDS ON ELECTRIC CIRCUITS; M. J. Myers, Syracuse, N. Y. App. filed June 9, 1900. Two primary coils act oppositely upon a secondary coil; the former are connected in circuit with a grounded source of electricity and to the two sides of the circuit to be tested. The current in the secondary coil gives the desired indication.

711,022. TROLLEY FOR ELECTRIC RAILWAYS; C. E. Thomas, Springfield, and J. M. Olinger, Vienna Crossroads, Ohio. App. filed July 21, 1902. The trolley harp is latched to the top of the pole, so that it can be removed when desired.

711,031. PROCESS OF MAKING GRAPHITE; E. G. Acheson, Niagara Falls, N. Y. App. filed Dec. 22, 1900. The method consists in heating carbon in an electrical furnace and introducing therein a volatile material capable of forming a carbid.

711,036. CIRCUIT CLOSER FOR TROLLEY SIGNALS; W. M. Chapman, Newton, Mass. App. filed March 9, 1901. A frame arranged above the wire and containing switch levers to be actuated by the trolley wheel.

711,037. RAILWAY BLOCK SIGNALING SYSTEM; W. M. Chapman, Newton, Mass. App. filed June 29, 1901. Details.

711,105. INSULATED RAIL JOINT; M. J. Greeney, Buffalo, N. Y. App. filed June 26,1902. The fish plates have lateral flanges facing each other at the joint, between which a sheet of insulating material is inserted.

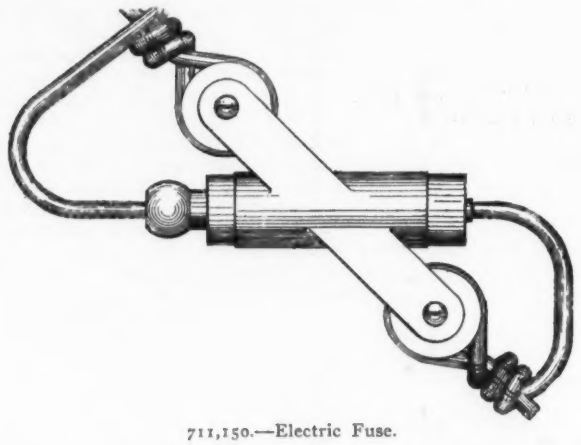
711,107. ELECTRICAL TRACTION SYSTEM; W. S. Hill, Hyde Park, Mass. App. filed March 31, 1902. The contact shoe is pivoted on the poles of a magnet and is forced by the latter into good contact with the studs.

711,122. ACCUMULATOR; J. B. Relm, Levallois-Perret, France. App. filed Dec. 4, 1901. A frame of peculiar construction in which the ends of rods, strips or the like are held.

711,123. WAVE DETECTOR; L. T. Rhoades, Phoenixville, Pa. App. filed Aug. 29, 1902. A self-recovering wave-responsive device, comprising metal terminals and a mixture of steel, nickel, carbon and vaseline between them.

711,130. WIRELESS TELEGRAPHY; H. Shoemaker, Philadelphia, Pa. App. filed Oct. 16, 1901. The spark gap is shunted by a condenser.

711,131. ART OF TRANSMITTING INTELLIGENCE; H. Shoemaker, Philadelphia, Pa. App. filed Aug. 9, 1902. The resistance of a material is



711,150.—Electric Fuse.

changed by altering the strength of a magnetic field in which it is located, such alterations being caused by the arriving currents.

711,132. WIRELESS SIGNALING SYSTEM; H. Shoemaker, Philadelphia, Pa. App. filed Aug. 9, 1902. The apparatus for carrying out the preceding method.

711,150. ELECTRIC FUSE; F. Brueggeman, Chicago, Ill. App. filed Jan. 11, 1902. The fuse is contained in a plug adapted to be suspended in the course of the wire.

711,174. WIRELESS SIGNALING SYSTEM; G. W. Pickard, Boston, Mass. App. filed June 22, 1901. In a wireless signaling system, a plurality of oscillating circuits of different natural periods and a radiating conductor common to all the circuits and operating simultaneously, and a frequency determining element for each of the circuits.

711,181. METHOD OF TRANSMITTING INTELLIGENCE; H. Shoemaker, Philadelphia, Pa. App. filed Jan. 11, 1902. A method of generating the energy in wireless telegraphy, at low pressure and low frequency and transforming it to energy of high pressure and high frequency.

711,182. SIGNALING SYSTEM; H. Shoemaker, Philadelphia, Pa. App. filed Sept. 5, 1902. The arriving current in a wireless system influences the magnetism existing in a magnetic mass, causing it to be moved to control local circuits.

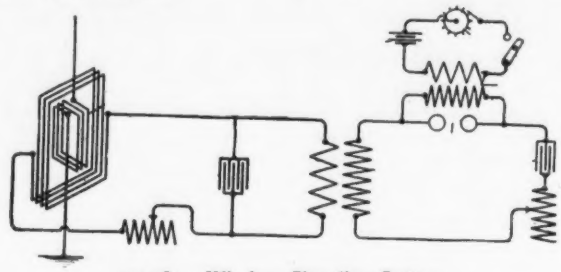
711,183. WIRELESS SIGNALING SYSTEM; H. Shoemaker, Philadelphia, Pa. App. filed Sept. 13, 1902. A system wherein an element of a signal is represented by a train of waves of energy, such trains succeeding each other at a predetermined and uniform rate.

711,184. WIRELESS SIGNALING SYSTEM; H. Shoemaker, Philadelphia, Pa. App. filed Sept. 16, 1902. An electrodynamometer is employed as a wave responsive device.

711,202. ELECTRIC SIGNALING SYSTEM; F. K. Fassett, St. Louis, Mo. App. filed June 13, 1898. Details of an up and down switch for elevators.

711,243. INCANDESCENT LAMP SOCKET; W. A. Church, Binghamton, N. Y. App. filed Jan. 10, 1902. Details.

711,246. ELECTRIC SWITCH; C. J. Doran, Jersey City, N. J. App. filed Jan. 11, 1902. Details.



711,184.—Wireless Signaling System.

711,256. INSULATED JOINT FOR TRACK CIRCUITS; S. P. McGouch, Newark, N. J. App. filed Jan. 13, 1902. Details.

711,266. WIRELESS SIGNALING SYSTEM; H. Shoemaker, Philadelphia, Pa. App. filed Sept. 13, 1902. A wave responsive device and a number of parallel circuits controlled thereby, each selective of a predetermined message.

711,276. APPARATUS FOR RECTIFYING ELECTRIC CURRENTS; G. B. Batten, Dulwich, England. App. filed June 29, 1901. Details.

711,286. TROLLEY; E. W. Clark, Columbus, Ga. App. filed April 9, 1902. The harp is hinged to the pole and latched in such a manner that when the wheel leaves the wire, the harp is caused to swing downward out of operative position.

711,292. ELECTRIC RAILWAY OR TRAMWAY; G. F. Cornwallis-West, London, England. App. filed May 23, 1902. A paving block of devitrified glass forming a section of the conduit.

711,300. ELECTROMAGNETIC TRANSMISSION GEAR; H. A. Earle, Manchester, England. App. filed Jan. 16, 1902. Consists of two members fixed on the ends of two shafts in alignment, one being a shell of iron traversed by copper rods, the other being an electro-magnet running inside of said shell.

711,319. OBJECT OF REFRACTORY MATERIAL AND METHOD OF MANUFACTURING SAME; C. B. Jacobs, East Orange, N. J. App. filed Dec. 26, 1900. Material containing an excess of silica is fused in an electric furnace to volatilize the excess of silica and leave a product harder and tougher than the original material.

711,375. PROCESS OF PURIFYING SUGAR JUICE BY MEANS OF ELECTRODIALYSIS; A. Baudry, Kiew, Russia. App. filed Feb. 28, 1899. Sulphurous acid added to the juice is caused to combine, when a current flows through the cell, with the hydrogen liberated at the cathode, to form hyposulphurous acid, which exerts a clarifying action on the juice.

711,386. MEANS FOR SIGNALING TO OR COMMUNICATING WITH SHIPS.; L. Daft and A. Williams, Wimbledon, England. App. filed June 29, 1901. Details.

711,414.—Underground Electrical Conductor.

711,411. INSULATED RAIL JOINT OR CONNECTION; J. H. Allen, East Orange, N. J. App. filed March 7, 1902. Details.

711,414. UNDERGROUND ELECTRIC CONDUCTOR; C. Borel, Lyons, France. App. filed June 11, 1902. To diminish excessive rises of voltage by sudden variations of conditions in a conductor, the conductor is covered by a conducting tube, which is insulated from it throughout its length, and the two conductors connected at one end through a suitable resistance.

711,421. APPARATUS FOR ELECTRICALLY LIGHTING RAILWAY TRAINS; A. B. Gill, London, England. App. filed Aug. 25, 1902. Details.

711,428.—TROLLEY RETRIEVER; A. W. Knutson, Galesburg, Ill. App. filed June 4, 1902. Spring drums controlled by a pawl and ratchet arrangement.

711,444. SIGNALING SYSTEM; H. Shoemaker, Philadelphia, Pa. App. filed Jan. 11, 1902. Apparatus for transforming the tension and frequency of the transmitting current in wireless systems.

711,445. ART OF TRANSMITTING INTELLIGENCE; H. Shoemaker, Philadelphia, Pa. App. filed Sept. 16, 1902. The method patent corresponding to apparatus described in No. 711,184.